DRAFT

Properly Functioning Condition

Process -- 12/23/96 -- Draft

January 21, 1997

This report is a compilation of three different activities. The first is the outline of the process of assessing Proper Functioning Condition. This process was developed using concepts of Proper Functioning Condition as outlined in the Bureau of Land Management publication: TR 1737-9, 1993, "Riparian Area Management, Process for Assessing Proper Functioning Condition" 52 pages. The process is an adaptation of the site specific riparian assessment process to larger scales and to upland conditions.

The second section is the application of the process at the scale of the Intermountain Region and the third section is the application of the process to a sub-regional scale.

Subsequent to these assessments some forests and districts have been applying the process at a landscape scale. No examples of the latter applications are included at this time.

The process and assessments fit within an ecological approach to management and within the concept of "Continuous Assessments and Planning".

The process and assessments herein are in draft form as refinements and corrections are made as experience and understanding accumulates. This document should be viewed more as a "work in progress" than a completed event.

PROPERLY FUNCTIONING CONDITION

December 23, 1996 Version

PHASE ONE

I. BACKGROUND

A team was assigned by the Directors to "Establish a process, including criteria and indicators, which will allow identification of areas not currently in a properly functioning condition" [PFC] (see Appendix A). Besides the assigned team; Steve Munson, Entomologist, Ogden Field Office, was recruited for consultation in developing criteria and indicators. Expectations and timelines for the phase one effort are in Appendix A.

II. CONCEPTS AND DEFINITIONS

The concept of properly functioning condition (PFC) is used as described in the publication:

Barrett and others, 1993. "Riparian Area Management" - TR 1737-9, U.S. Department of the Interior, Bureau of Land Management, 52p.

The Intermountain Region team was charged with taking the site specific BLM concept and process and apply it to larger scales and to upland conditions. This paper is the documentation of that effort.

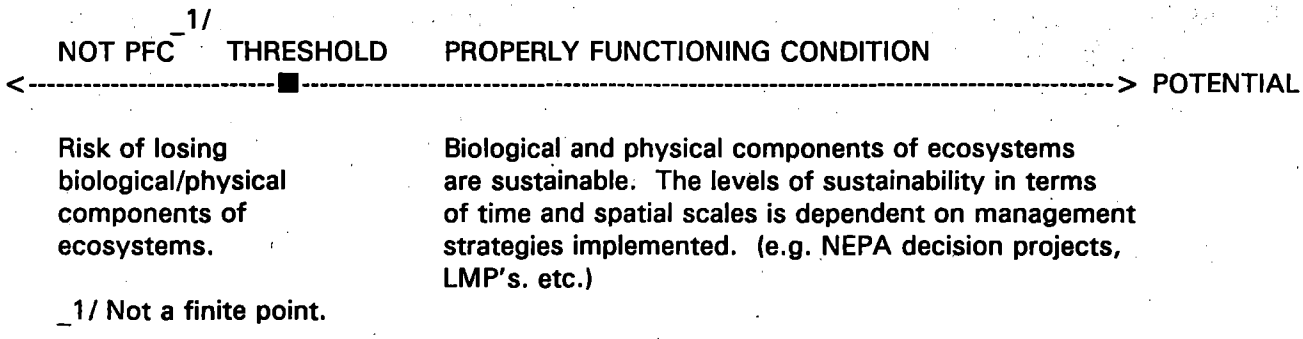
PFC is a rapid assessment process and is a part of a greater whole. This greater whole is termed "Taking an Ecological Approach". The less precise term of "Ecosystem Management" is used by many as it is shorter than the phrase "taking an ecological approach". Much of the philosophical foundation for an ecological approach and the Intermountain Region PFC process is given in the publication:

Kaufmann and others, 1994. "An Ecological Basis for Ecosystem Management", General Technical Report RM-246. Rocky Mountain Forest and Range Experiment Station, Ft. Collins Colorado. 22 p.

Definitions of PFC and "Risk" were developed by the team to guide process development and to identify systems at risk of not being in PFC. (It is important to remember that PFC is limited to biological and physical conditions and does not reflect potential management strategies.)

Properly Functioning Condition - Ecosystems at any temporal or spatial scale are in a properly functioning condition when they are dynamic and resilient to perturbations to structure, composition, and processes of their biological or physical components.

Risk - Risk refers to situations in which the outcome is not certain, but the chance of system degradation beyond the point of resiliency and sustainability can be estimated.



_1/ Not a finite point.

III. ECOLOGICAL APPROACH

All PFC assessments should use an ecological approach. An ecological approach requires consideration of three spheres {termed "ecological capabilities" and "social and economic needs" by Kaufmann and others, 1994.} 1. biological and physical (bio-physical), 2. social, and 3. economic. Although PFC works mainly within the bio-physical sphere there is significant relevance to the social and economic spheres. For example:

The Forest Service is charged by laws to maintain certain standards such as clean water, clean air, endangered species and soil conservation while at the same time is directed to provide for a variety of goods and services. These laws not only reflect the biological and physical needs for land stewardship but in large part the social expectations of the public. Using an ecological approach requires that each sphere be characterized before synthesizing all three into a sustainable range of choices to complete the entire assessment phase. All possible choices should provide for a PFC of the biological and physical sphere and allow management to implement sustainable proposals that move ecosystems toward their potential.

This is a "coarse filter approach". The assumption is that if vegetative communities and their processes are similar today to those occurring historically; then conditions approximate those under which species evolved. Presumably, therefore, the full complement of species will persist. Kaufmann and others put it in these words:

> **"Our working assumption is that naturally evolving ecosystems (minimally influenced by humans) were diverse and resilient, and that within the framework of competition, evolutionary pressure, and changing climates, these ecosystems were sustainable in a broad sense. Many present ecosystems modified by modern industrial civilizations do not have all these characteristics. Our guiding premise for sustaining ecosystems and protecting biodiversity now and into the future is to manage ecosystems such that structure, composition and function of all elements; including their frequency, distribution, and natural extinction, are conserved. Conservation focuses on maintaining and restoring suitable amounts of representative habitats over the landscape and through time."**

The PFC assessment process is a coarse filter approach to ecosystem sustainability. The most basic concept inherent in an ecological approach and in PFC is sustainability.

IV. PROCESS

A. Design

The design includes three scales: Regional; Sub-Regional; and Landscape. These scales are directly related to the Forest Service National Hierarchial Framework of Ecological Units developed under a policy of ecosystem management adopted by USDA Forest Service June 4, 1992. Planning and analysis scales were used instead of the hierarchical framework scales for simplicity and because PFC is a planning assessment. Use of any planning and analysis scales for assessments should include full consideration of the ecological units within the hierarchical framework. Refer to Exhibit A for an overview of how the two systems are related. The publication "Ecological Subregions of the United States: Section Descriptions" dated July 1994 is an invaluable reference for any assessments.

Basic characteristics of ecosystems include 1. Structure, 2. Composition, 3. Processes, 4. Patterns. A matrix with these four characteristics as criteria and at three scales (See Exhibit B), was developed to assess PFC. The matrix is used to describe each individual subject area to be assessed. At the scale of the Intermountain Region the subject areas include sixteen vegetation types, a hydrologic regime, a soil quality description, and an aquatic and terrestrial animal

description. Indicators of a properly functioning condition were developed for each subject area, by criteria, and at each scale.

Criteria include structure, composition, disturbance regime (processes), and patterns. Structure is a means to express the balance of age and size classes for included subject areas related to vegetation types. A defined balance of size classes was estimated to reflect one that would sustain the type in the long term. Simply this means there must be adequate recruitment in the type to sustain a range of age classes. For many of the conifer types the selected range of classes included: 10 percent Grass/Forb; 10 percent Seedling/Sapling; 20 percent Young Forest; 20 percent Mid Aged Forest; 20 percent Mature Forest; and 20 percent Old Forest. These percentages are estimates or approximations. The basis for using these vegetative structural stages comes from the work done by a Northern Goshawk Scientific Committee in 1990-1992. This committee recommended this mixture of classes because it sustained both forest cover types and a large suite of wildlife species. There are individual exceptions that can be provided for but in general if these proportions are sought after by management most of the wildlife and social needs in forested landscapes can be met. For other subject areas such as non conifers, non forest types, riparian/wetlands, soil quality, hydrologic regime, and aquatic and terrestrial animals structure is expected to reflect a balance not exceeding the sustainable biological and physical capabilities of the resource. The indicators for these subject areas are based on the experience and education of the team members and the knowledge of the scientific studies.

Ecosystems vary in time and space. Changes may be rapid or gradual but change occurs. The term "historical range of variation" refers to ecosystem compositions, structures, processes and patterns for a specified time and for a specific area. The potential for survival of native species is reduced if their environment is pushed outside the range of natural variation. Ecosystems have the capacity to change drastically over short or long periods of time and from place to place. As a result, ecosystem components and processes are adapted to a range of conditions. It is believed that native species adapted to and, in part, evolved with the disturbance events of the preceding several thousand years. This provided patterns of landscape and ecosystem variation that were apparently self-sustaining. Successive generations of the same biota under the same conditions give the best indication of sustainability.

In the western states, the conditions present prior to European settlement is often used to indicate the historical range of variability. Conditions then are more readily determined than those of earlier times and many biotic and abiotic elements are continuous from then to the present (e.g. many individual plants and most landforms are the same or little changed). The full range of historical variation includes any process or pattern which may or probably could have occurred on a given landscape over time, under natural conditions. This definition is relatively narrow, and reflects those processes which were more cyclical and occurred with a more or less predictable frequency. Examples would includes cycles of drought, fire incidence and population fluctuations in biota.

For example, the range of historical variation for an area would include evidences of the light to moderate intensity fires which swept through an open ponderosa pine savannah every 7 to 12 years over a 100 year period prior to European settlement. The range of historical variation would not usually include an event which occurred once in 500+ years when an intense fire combined with an intense rainstorm produced massive amounts of sediment on the same area. That possibility would be described, but not included in the general definition of range of historical variation for that particular area (extreme events versus more normal, reoccurring events). Generally, 100 to 500 years prior to the present is the most commonly employed time frame.

Composition is an expression of species present in each of the subject areas. For vegetation and fauna this includes the dominant species. In the case of vegetation it means the recruitment and sustainability of early seral species while still providing the diversity of all successional species (flora and fauna). In many of the non forest types this requires a smaller coverage of mature plants to allow development of ground cover species such as grass, forbs, and shrubs to limit the amount of bare soil.

Disturbance regime was used to characterize processes and includes all known historical disturbances that have effected the ecosystems. These include past grazing, human trampling, logging, foraging by wildlife ungulates, wind, flood, insects, diseases, and fire. Each ecosystem has some distinction concerning which disturbance factors are or have been active. The most common factors are fire, insects and disease. For each ecosystem the historical fire regime was described in terms of lethal and not lethal fire intensities and frequencies. This was based on available sources of information from published research and recorded histories. Insect and disease conditions were based on current and past aerial surveys for the ecosystem and the known scientific work and experience. More fundamental ecosystems processes such as carbon balances, nutrient and energy cycles, etc. are more difficult and costly to ascertain at broad scales so disturbance regimes were used as a more easily observed surrogate.

Patterns are an indication of how ecosystems function among and between themselves. Criteria addressed the size, shape, age class, distribution, and juxtaposition of structures in and adjacent to each ecosystem. Patterns are evaluated by comparison to their historical ranges (e.g. 100-500 years) using principles of landscape ecology. Changes between ecosystems such as juniper movement into big sagebrush/grass and conifer succession into aspen were not the primary objective of the criteria. These changes between subject areas are intended to be considered by resource managers as major decisions to meet specific management objectives.

Threshold areas are identified to establish acceptable ranges of PFC to provide for ecosystem sustainability and resiliency. Thresholds are developed using the concept of the historical range of variation.

SUBJECT AREAS:

- Alpine
- Subalpine timberline forests and woodlands
- Engelmann spruce - subalpine fir
- Quaking aspen
- Lodgepole pine
- Grand fir/white fir complex
- Interior Douglas-fir
- Ponderosa pine/Jeffrey pine complex
- Ponderosa pine Southern Utah type
- Pinyon - Juniper
- Mountain mahogany
- Gambel oak
- Tall Forb
- Mountain brush complex
- Big sagebrush/Grasslands
- Hydrologic regime
- Soil quality
- Riparian/wetlands
- Aquatic and terrestrial animals -

To assist the assessment process a "Standard Checklist" (Exhibit C) was created for an assessment team's use. In addition the Standard Checklist for Riparian/Wetlands (Exhibit D) developed by the Bureau Of Land Management should be used specifically for the riparian/wetlands subject area. These checklists will provide a place for initiating discussion and conducting the assessment.

B. Assessment Process

1. Define scale of assessment (temporal and spatial).

2. Assemble team of technical experts for scale(s) being considered.

3. Utilize the appropiate matrices by subject area to determine kind of resource information needed and available.

4. Select the appropriate subject areas and assess whether they are or are not in PFC.

5. If subject area(s) are not in (PFC) estimate the degree of departure from the PFC.

6. Summarize the results for the selected geographical and temporal scale and estimate a relative risk in terms of subject area or combinations of subject areas.

EXHIBIT A: Introduction from: "Ecological Subregions of the United States: Section Descriptions". Compiled by W. Henry McNab and Peter E. Avers. July 1994. United States Department of Agriculture, Forest Service, Ecosystem Management, Washington, DC.

Introduction

Background

The USDA Forest Service adopted a policy of ecosystem management on June 4, 1992, that applied to national forests, grasslands and research programs. By July, an Ecological Classification and Mapping Task Team (ECOMAP) was formed in the Washington Office to develop a consistent approach to ecosystem classification and mapping at multiple geographic scales. This was identified by the Chief as a critical first step in providing field units with an essential tool and scientific basis to plan for and implement ecosystem management. Soon afterwards a subgroup of ECOMAP was formed with representatives from all Forest Service Regions, two Research Stations, the USDA Soil Conservation Service, and The Nature Conservancy. They met in September in Lincoln, NE, to begin development of a land classification system. The structure of the National Hierarchical Framework of Ecological Units (Table 1) was formulated at this meeting and was adopted by the Forest Service on November 5, 1993 (ECOMAP 1993).

Briefly, as described by ECOMAP (1993), the Framework "...is a regionalization, classification, and mapping system for stratifying the Earth into progressively smaller areas of increasingly uniform ecological potentials. Ecological types are classified and ecological units are mapped based on associations of those biotic and environmental factors that directly affect or indirectly express energy, moisture, and nutrient gradients which regulate the structure and function of ecosystems. These factors include climate, physiography, water, soils, air, hydrology, and potential natural communities."

In November 1992, the subgroup began the process of producing a national map of ecological units at the Section level of the subregion planning and analysis scale. During the process of delineating Sections, ecoregion boundaries were revised. The map "Ecoregions and Subregions of the United States" was compiled by December 1993 and printed in June 1994 (Bailey and others 1994). The Section map unit descriptions in this text were produced after the map was compiled. A new, revised ecoregion map was also printed in June 1994. Bailey's publication (Bailey, 1980), which describes the Domains, Divisions, and Provinces of the United States is being revised (Bailey, In prep.).

Work is underway by the Forest Service and other agencies to subdivide Sections into Subsections, the next lower level in the hierarchy. In addition, maps are being developed at landscape and land unit scales on national forests and other selected areas in the United States to provide detailed information for project implementation. Thus, delineation and description of ecosystems at all levels in the hierarchy are components of an ongoing process that will result in a series of maps and explanatory texts to meet planning and analysis objectives (Figure 1). Each map and each descriptive text documents our current knowledge and provides a basis for study and communication among natural resource managers and planners.

In summary, the National Hierarchical Framework provides a scientific basis for regionalization of ecosystems into successively smaller, more homogeneous units. At the Section level, these units allow managers, planners, and scientists in the Forest Service, and in cooperation with other agencies, to study management problems on a multi-forest and statewide basis; organize data collected during broad-scale resource inventories; and interpret these data among regions.

Table 1.–The Forest Service National Hierarchical Framework of Ecological Units.

Planning and analysis scale	Ecological units	Purpose, objectives, and general use	General size range
Ecoregion			
Global	Domain	Broad applicability for modeling and sampling, strategic planning and assessment, and international planning	Millions to tens of thousands of square miles
Continental	Division		
Regional	Province		
Subregion	Section	Strategic, multi-forest, statewide, and multi-agency analysis and assessment	Thousands to tens of square miles
	Subsection		
Landscape	Landtype association	Forest, area-wide planning and watershed analysis	Thousands to hundreds of acres
Land unit.	Landtype	Project and management area planning and analysis.	Hundreds to less than ten acres.
	Landtype phase.		

EXHIBIT B:

SUBJECT:	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE			
COMPOSITION			
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)			
PATTERNS (e.g. connectivity, shapes, size, distribution)			

EXHIBIT C: **STANDARD CHECKLIST** (All subject areas except Riparian/Wetlands)

Subject Area Name: _____

Date: _____ **ID Team Members:** _____

Yes	No	N/A	SOIL/HYDROLOGIC
			(1). Surface litter, duff, plant residue and large woody debris is present in quantities sufficient to sustain soil productivity and nutrient cycling.
			(2)., Ground cover is adequate to protect soils from eroding by overland flow.
			(3). Soil infiltration/percolation is adequate to prevent or reduce overland flow.
			(4). Water and sediment being supplied by the watershed to the stream is in balance with the stream's transport capability.
			(5). Vegetation provides adequate cover and soil binding properties to reduce erosion and encourage infiltration of water.

Yes	No	N/A	VEGETATIVE
			(6). Structural classes diverse or balanced for sustainability or recovery.
			(7). Diverse composition of vegetation or preferred seral species.
			(8). Insect and disease populations at endemic levels.
			(9). Fire regimes within historical ranges.
			(10). Other disturbance regimes within historical ranges.
			(11). Patterns among and between subject areas consistent with historical ranges for ecological units.

Yes	No	N/A	AQUATIC AND TERRESTRIAL ANIMALS
			(12). Age classes and reproductive cohorts of native amphibians, fish and (vertebrate and invertebrate) wildlife are present, and adequate to maintain sustainable populations within historical ranges.
			(13). Physical and biological habitat elements (communities, species, stages, morphology) are available within seasonal home ranges of native species.
			(14). Native fish, amphibian and wildlife species are present in sustainable populations in adapted habitats.
			(15). Historical predators, competitors, prey, and habitat modification processes are present, supporting species' viability and sustainability.
			(16). Exotic species, diseases, or human uses do not limit, displace, or reduce viability of native species.
			(17). Disturbances affect only small portions of animal's annual ranges. (Especially for small, sedentary species with limited movement.)
			(18). Animal populations exhibit genetic integrity and diversity, and successful reproductive interchange, without isolation, across historically occupied habitats. Migration, distribution and reproduction unhindered by habitat management or disturbance within historical ranges.

EXHIBIT D:

STANDARD CHECKLIST

(From "Riparian Area Management - TR 1737-9, 1993. BLM, pp. 41-42)

Name of Riparian-Wetland Area:_____

Date:_____ Area/Segment ID;_____Miles_____

ID Team Observers:_____

Yes	No	N/A	HYDROLOGIC
			1) Floodplain inundated in "relatively frequent" events (1-3 years)
			2) Active/stable beaver dams
			3) Sinuosity, width/depth ration, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
			4) Riparian zone is widening or has achieved potential extent
			5) Upland watershed not contributing to riparian degradation

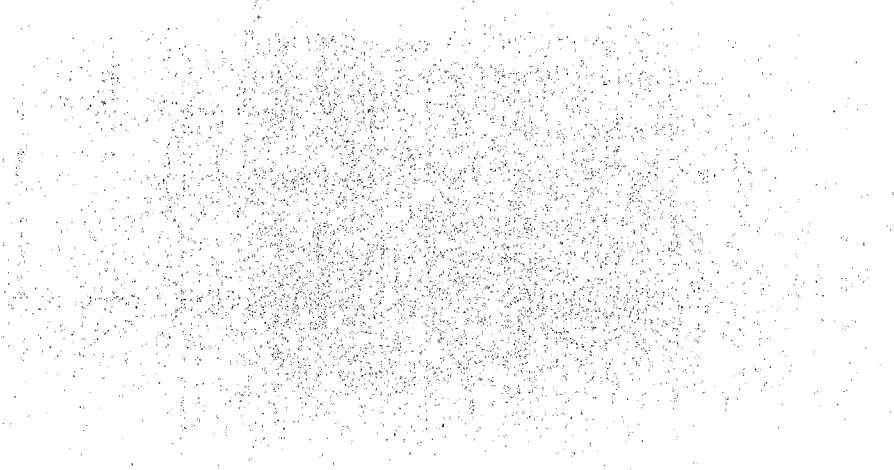
Yes	No	N/A	VEGETATIVE
			6) Diverse age-class distribution (recruitment for maintenance/recovery)
			7) Diverse composition of vegetation (for maintenance/recovery)
			8) Species present indicate maintenance of riparian soil moisture characteristics
			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events
			10) Riparian plants exhibit high vigor
			11) Adequate vegetative cover resent to protect banks and dissipate energy during high flows
			12) Plant communities in the riparian area are an adequate source of coarse and/or large woody debris

Yes	No	N/A	SOILS-EROSION DEPOSITION
			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody debris) adequate to dissipate energy
			14) Point bars are revegetating
			15) Lateral stream movement is associated with natural sinuosity
			16) System is vertically stable
			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1995)

APPENDIX A:

CHARTER TO TEAM AND TEAM MEMBERS



In late February and early March of 1996, the Regional Forester for the Intermountain Region developed a list of Ecosystem Management Expectations and priorities. The first priority on the list was stated as:

> **In total, our management actions are designed to ensure the public's riparian areas, rangelands and forest are in a "properly functioning condition."**

As part of this priority setting and direction a meeting was called by the Board of Directors on March 8, 1996 and a team assembled. The following written direction was given the team:

Tasks Related to Identifying
Properly Functioning Condition

Phase One - Identification: Establish a process, including criteria and indicators, which will allow identification of areas that are not currently in a PFC.

Phase Two - Evaluation: Establish procedures which assure appropriate identification and evaluation of risks, costs, and benefits.

Phase Three - Decision Phase: Define organizational strategy which allows strategic decisions to be made resulting in establishing priority for treatment across time.

Phase Four - Implementation Phase: While conducted by Forest/Eco-Groups, there is a critical need to assure that budget, training, and policy and procedural direction or guidance enables this phase.

Phase Five - Monitoring Phase: Monitoring Phase - Monitoring would be conducted at various scales to determine how well we are performing in increasing and maintaining the acreage of National Forest System land that is in a properly functioning condition.

The Board of Directors selected a team with Jack Amundson as team leader.

Team Leader:

Jack Amundson, Regional Silviculturist.

Members:

Karen Ogle, Fire Ecologist, Boise National Forest.
Alma H. Winward, Regional Ecologist.
Peter J. Stender, Regional Hydrologist.
David A. Newhouse, Regional Wildlife Ecologist.
Thomas M. Collins, Regional Soil Scientist.
Kris Lee, Regional Fisheries Program Manager
David M. Neeley, Transportation Systems Engineer.

Jack Amundson requested that Clinton K. Williams be added to the team and it was done.

The Board of Directors gave the following Expectations and Timeline:

- To expand the concepts developed for the riparian areas as defined by Wayne Elmore, BLM, and transfer in a holistic manner to the uplands.

- At Phase One, the team is charged to identify a process, establish criterion, and test this methodology in one or more areas.

- We expect that a draft of the process is developed by April 1 and presented to the Resource

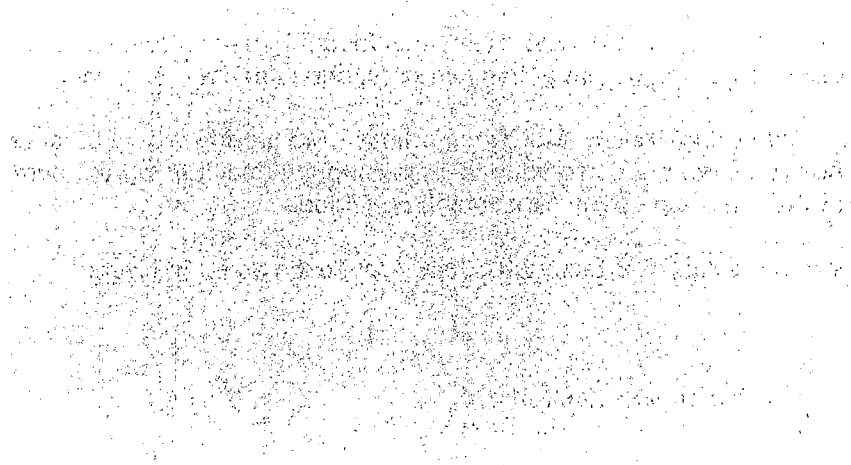
Directors and representative for Forest Service Research for review and comment.

- By May 1, we expect a final draft of the process including criteria for identification.

- At the May Leadership Team Meeting, we expect this team would present its final product and elicit Forest volunteers for testing.

- After test phase is completed (1 month), we expect a final product for decision.

- In that this team is charged with only Phase One, and we see need for another team to develop Phase Two, we expect this team to share information and embrace Team Two and its objectives.



APPENDIX B:

SUBJECT AREAS

SUBJECT: ALPINE	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Characterized by a lack of arboreal vegetation, landscape dominated by shallow soils, fell-fields, boulders, tundra and turf-forming vegetation with some areas with low shrubs. (e.g. <1 ft. tall.)	Characterized by a lack of arboreal vegetation, landscape dominated by shallow soils, fell-fields, boulders, tundra and turf-forming vegetation with some areas with low shrubs. (e.g. <1 ft. tall.)	Characterized by a lack of arboreal vegetation, landscape dominated by shallow soils, fell-fields, boulders, tundra and turf-forming vegetation with some areas with low shrubs. (e.g. <1 ft. tall.)
COMPOSITION	Dominated by native, perennial plant species. Indicator lichens and bryophytes are within historical ranges.	Native perennial plant cover ≥50%. Indicator lichens and bryophytes are within historical ranges.	Bare ground < 20%. Indicator lichens and bryophytes are within historical ranges.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Trampling, treading and herbivory are within historical ranges. Hydrologic regime within historical ranges.	Trampling, treading and herbivory are within historical ranges. Catchment, storage and release of water within historical ranges.	Trampling, treading and herbivory are within historical ranges. Catchment, storage and release of water within historical ranges.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Pattern of rocks, boulder fields and alpine plant communities within historical ranges.	Boulder fields, alpine turf and meadows within historical ranges.	Boulder fields, alpine turf and meadows within historical ranges.

SUBJECT: SUBALPINE TIMBERLINE FORESTS (primarily dominated by 5-needle pines)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structures, sizes and age classes. 20-40% of acres have trees greater than 10 feet tall and 80 or more years of age.	Balanced range of structures, sizes and age classes. 20-40% of acres have trees greater than 10 feet tall and 80 or more years of age.	Balanced Range: Grass/forb, seedlings and saplings = 10-20%* Young, Mid Aged and mature forest = 30-50%* Old Forest = 20-40%* [Basal areas typically are less than 100 square feet and SDI is less than 100.] (* indicates proportion of acres)
COMPOSITION	More than 70 % of trees are 5 needle pines (e.g. whitebark, limber or bristlecone) and less than 20% of trees are spruce, true firs or Douglas-fir.	More than 70 % of trees are 5 needle pines (e.g. whitebark, limber or bristlecone) and less than 20% of trees are spruce, true firs or Douglas-fir.	More than 70 % of trees are 5 needle pines (e.g. whitebark, limber or bristlecone) and less than 20% of trees are spruce, true firs or Douglas-fir.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic levels of insect and disease activity are present. Less than 10% of acres have white pine blister rust present. Fire regime is mixed severity with a 100-150 year interval between stand-replacing fires.	Endemic levels of insect and disease activity are present. Less than 10% of acres have white pine blister rust present. Fire regime is mixed severity with a 100-150 year interval between stand-replacing fires.	Endemic levels of insect and disease activity are present. Pockets of mortality do not exceed groups of 5 trees per acre. Aerial detection surveys indicate mortality does not occur in groups exceeding 10 trees. Less than 10% of the 5 needle pine trees have white pine blister rust present. Fire regime is mixed severity with a 100-150 year interval between stand-replacing fires and 50-70 years between surface fires..
PATTERNS (e.g. connectivity, shapes, size, distribution)	Open forests to woodlands, canopies do not close and trees are distributed in sparse stands or widely spaced clumps of trees.	Open forests to woodlands, canopies do not close and trees are distributed in sparse stands or widely spaced clumps of trees.	Open forests to woodlands, canopies do not close and trees are distributed in sparse stands or widely spaced clumps of trees.

SUBJECT: ENGELMANN SPRUCE - SUBALPINE FIR (*Picea engelmannii - Abies lasiocarpa*)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages.	40% is Mature and Old.	Balanced Range: Grass/forb ≈10% Seedling/Sapling ≈10% Young Forest ≈20% Mid Aged Forest ≈20% Mature Forest ≈20% Old Forest ≈20% 40% of the stands have multiple canopies. Stand Density Index (SDI) not greater than 335 and Basal Area less than 150.
COMPOSITION	Engelmann spruce is dominant.	More than 40% of trees are Engelmann spruce.	More than 40% of trees are Engelmann spruce.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insect and disease populations. <10% of the host type has root disease centers. Fire regimes are within historical ranges. Lethal fire regime on a 100 to 300 year cycle.	Endemic insect and disease populations. Insect and disease activity in groups of <50 trees. Fire regimes are within historical ranges. Lethal fire regime on a 100 to 300 year cycle.	Endemic insect and disease populations. No defoliation of >50% of crown is observed. Mortality in groups of <5 or more trees per acre. Avalanche, windthrow or landslides do not affect more than 2% of the spruce trees 10 inches or greater dbh. < 5% of acres in root disease centers. Fire regimes are within historical ranges. Mixed severity and lethal fire regimes. Mixed severity regime on a 50 to 80 year cycle and lethal regime on a 100 to 300 year cycle.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns are within historical ranges. The role of fire is to influence species distribution and age classes.	Patterns are within historical ranges. (corridors present and functional.) The role of fire is to influence the distribution of structure classes, composition, and pattern across the subregion.	Patterns are within historical ranges. (Pattern sizes, shapes and corridors are maintaining processes.) The role of fire is to maintain a heterogenous pattern of species and structure classes. A mixed severity fire regime produces vegetation mosaics due to patchy nature of the fire, preventing development of large continuous blocks of homogenous ages and species.

SUBJECT: ASPEN (*Populus tremuloides*)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages.	30% is Mature and Old age classes.	Balanced Range: Grass/forb and regeneration and saplings ≈ 40% Young, Mid Aged and mature forest ≈ 30% Old Forest ≈ 30% Stand Density Index (SDI) not greater than 300 and Basal Area less than 140.
COMPOSITION	Aspen is dominant. Less than 15%of area is succeeding to other cover types. Shrub and herbaceous layers well developed.	Conifer encroachment is minimal (e.g. Conifer composition not more than 15% cover in stands.) Shrub and herbaceous layers well developed.	Mature and Old Forest aspen less than 150 years old. Conifer composition not more than 15% cover in stands. Shrub and herbaceous layers well developed. Ground cover nearly 100%.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insect and disease populations. Insect activity affects 20% or less of type. Fire regimes are within historical ranges. The fire regime is a lethal fire regime burning on a 20 to 100 year cycle.	Endemic insect and disease populations. <10% of clones with root disease. Tree mortality <10% in mature and old age classes. Fire regimes are within historical ranges. The fire regime is a lethal fire regime burning on a 20 to 100 year cycle.	Endemic populations of insects and disease. <30% topkill and branch mortality in mature and old age classes. A fire interval of 20 to 50 years generally occurs in seral stands. Low to moderate intensity surface fires slow conifer encroachment. Intervals that approach 100 years are typical of climax aspen stands that don't require frequent disturbance to perpetuate the clone.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns are within historical ranges. The role of fire is to maintain presence of aspen.	Patterns are within historical ranges. (corridors are present and functional.) The role of fire is to influence distribution of structural classes and patterns across the subregion.	Patterns are within historical ranges. (Pattern sizes, shapes and corridors are maintaining processes.) The role of fire is to influence distribution of structural classes and patterns across landscapes.

SUBJECT: LODGEPOLE PINE (*Pinus contorta*)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages.	40% is Mature and Old.	Balanced Range: Grass/forb ≈10% Seedling/Sapling ≈10% Young Forest ≈20% Mid Aged Forest ≈20% Mature Forest ≈20% Old Forest ≈20% 20% of the stands have multiple canopies. Stand Density Index (SDI) not greater than 350 and Basal Area less than 90 sq. ft.
COMPOSITION	Lodgepole pine is dominant.	More than 80% of the trees are lodgepole pine.	More than 80% of trees are lodgepole pine
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insect and disease populations. Fire regimes are within historical ranges. The fire regime is lethal. Fires occur every 150 to 300 years.	Endemic insect and disease populations. Fire regimes are within historical ranges. The fire regime is lethal. Fires occur every 150 to 300 years.	Endemic insect and disease populations. Fire regime is a combination of mixed severity and lethal. Persistent lodgepole stands are typically in the lethal fire regime. Fires burn every 150 to 300 years in the lethal regime.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns are within historical ranges. The role of fire is to maintain presence of lodgepole pine stands.	Patterns are within historical ranges. (corridors are present and functional.) The role of fire is to maintain presence of lodgepole pine stands.	Patterns are within historical ranges. (Pattern sizes, shapes and corridors are maintaining processes.) Fire maintains a heterogenous pattern of age and size classes across the landscape.

SUBJECT: GRAND FIR/WHITE FIR COMPLEX (Assumed to be managed for seral species such as Douglas-fir, ponderosa pine or western larch)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages.	40% is Mature and Old.	Balanced Range: Grass/forb ≈10% Seedling/Sapling ≈10% Young Forest ≈20% Mid Aged Forest ≈20% Mature Forest ≈20% Old Forest ≈20% Not more than 50% of the stands have multiple canopies. Stand Density Index (SDI) not greater than 335 and Basal Area less than 180.
COMPOSITION	Ponderosa pine, western larch and Douglas-fir are dominant.	More than 75% is ponderosa pine, western larch and Douglas-fir	Grand fir/white fir composition is less than 25%.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insect and disease populations affect less than 5% of the host type. Fire regimes are within historical ranges. This is a nonlethal fire regime. The fire interval ranges from 10 to 60 years.	Endemic insect and disease populations affect 10% or less of host type. Pockets of mortality do not have more than 50 trees. Fire regimes are within historical ranges. The fire interval ranges from 10 to 40 years on dry sites. On more mesic sites the interval is longer (30 to 60 years).	Endemic insect and disease populations. No defoliation of more than 50% of the crowns. Mortality pockets not greater than 5 trees per acre with more than 10 trees in a group. Fire regimes are within historical ranges. The fire interval ranges from 10 to 40 years on dry sites. On more mesic sites the interval is longer (30 to 60 years).
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns are within historical ranges. The role of fire is to maintain seral stands of ponderosa pine/Douglas-fir/ western larch/ lodgepole pine with fir as a minor component.	Patterns are within historical ranges. (corridors are present and functional.) Fire maintains dominance of seral species with fir as a minor component.	Patterns are within historical ranges. (Pattern sizes, shapes and corridors are maintaining processes.) Fires of low to moderate severity favor open, seral stands of ponderosa pine, Douglas-fir and western larch and possibly lodgepole pine.

SUBJECT: INTERIOR DOUGLAS-FIR (*Pseudotsuga menziesii*)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages.	40% is Mature and Old.	Balanced Range: Grass/forb ≈10% Seedling/Sapling ≈10% Young Forest ≈20% Mid Aged Forest ≈20% Mature Forest ≈20% Old Forest ≈20% Not more than 50% of the stands have multiple canopies. Stand Density Index (SDI) not greater than 298 and Basal Area less than 160.
COMPOSITION	Ponderosa pine or Douglas-fir are dominant.	More than 75% is ponderosa pine or Douglas-fir.	True fir composition is less than 25%.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insect and disease populations affecting 5% or less of the host type. Fire regimes are within historical ranges. This is a mixed severity fire regime with an interval of 10 to 50 years.	Endemic insect and disease populations affecting less than 10% of the host type and not over 25 trees in a mortality group. A nonlethal and mixed severity fire regime. On dry sites the interval ranges from 10 to 25 years and typically is a nonlethal surface fire. On cooler, wetter sites, the interval is longer (30 to 50 years) and fires burn under the mixed severity regime.	Endemic insect and disease populations with less than 50% crown defoliation. Mortality less than 5 trees per acre in groups of less than 10 trees. Less than 15% of acres with root disease centers. A nonlethal and mixed severity fire regime. On dry sites the interval ranges from 10 to 25 years and typically is a nonlethal surface fire. On cooler, wetter sites, the interval is longer (30 to 50 years) and fires burn under the mixed severity regime. Fires of low to moderate severity open dense stands of pole-sized or larger trees. Subsequent light burns maintain these stands in a park-like condition.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns are within historical ranges. Fire's role is to maintain Douglas-fir or ponderosa pine where they are seral species.	Patterns are within historical ranges. (corridors are present and functional.) Fire's role is to maintain Douglas-fir or ponderosa pine where they are seral species.	Patterns are within historical ranges. (Pattern sizes, shapes and corridors are maintaining processes.) Fire's role on dry and mesic sites is to prevent a shade tolerant understory from developing. Subsequent light burns maintain these stands in a park-like condition.

SUBJECT: PONDEROSA PINE/JEFFREY PINE COMPLEX (*Pinus ponderosa, Pinus jeffreyi*)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages.	20% is in grass/forb and seedling/sapling stages with 40% in Mature and Old stages.	Balanced Range: Grass/forb ≈10% Seedling/Sapling ≈10% Young Forest ≈20% Mid Aged Forest ≈20% Mature Forest ≈20% Old Forest ≈20% 75% of multiple canopy structure is ponderosa or Jeffrey pine. Stand Density Index (SDI) not greater than 234 and Basal Area less than 140.
COMPOSITION	Ponderosa or Jeffrey pine is dominant.	More than 75% is ponderosa or Jeffrey pine.	More than 75% of trees are ponderosa or Jeffrey pine.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insect and disease populations. 5% or less of host type with insect activity and 30% or less of trees have dwarf mistletoe. Fire regime is a nonlethal type with a fire return interval of 5 to 25 years.	Endemic insect and disease populations. Tree mortality not over 10% of host type and mortality groups have less than 50 trees. <40% of trees have dwarf mistletoe; <10% with stem rust and root disease centers. Fire regime is a nonlethal type with a fire return interval of 5 to 25 years.	Endemic insect and disease populations. Pockets of mortality do not exceed 5 trees per acre. Mortality groups of <10 trees. <1% of trees with black stain, <10% with root disease, <20% with dwarf mistletoe or stem rust. Fire regime is a nonlethal type with a fire return interval of 5 to 25 years.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns are within historical ranges. The role of fire is to maintain both seral and climax stands of ponderosa pine or Jeffrey pine.	Patterns are within historical ranges. (corridors are present and functional.) The role of fire is to maintain both seral and climax stands of ponderosa or Jeffrey pine.	Patterns are within historical ranges. (Pattern sizes, shapes and corridors are maintaining processes.) The role of fire is to maintain open stands of pine by removing competing shade tolerant understory fir seedlings. Periodic fires can create uneven-aged stands comprised of groups of trees that vary in age from group to group.

SUBJECT: PONDEROSA PINE - SOUTHERN UTAH(*Pinus ponderosa*)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages.	20% is in grass/forb and seedling/sapling stages with 40% in Mature and Old stages.	Balanced Range: Grass/forb ≈10% Seedling/Sapling ≈10% Young Forest ≈20% Mid Aged Forest ≈20% Mature Forest ≈20% Old Forest ≈20% 75% of multiple canopy structure is ponderosa pine. Stand Density Index (SDI) not greater than 158 and Basal Area less than 120.
COMPOSITION	Ponderosa pine is dominant.	More than 75% is ponderosa pine.	More than 75% is ponderosa pine.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insect and disease populations. 5% or less of host type with insect activity and 30% or less of trees have dwarf mistletoe. Fire regime is a nonlethal type with a fire return interval of 5 to 25 years.	Endemic insect and disease populations. Tree mortality not over 10% of host type and mortality groups have less than 50 trees. <40% of trees have dwarf mistletoe; <10% with stem rust and root disease centers. Fire regime is a nonlethal type with a fire return interval of 5 to 25 years.	Endemic insect and disease populations. Pockets of mortality do not exceed 5 trees per acre. Mortality groups of <10 trees. <1% of trees with black stain, <10% with root disease, <20% with dwarf mistletoe or stem rust. Fire regime is a nonlethal type with a fire return interval of 5 to 25 years.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns are within historical ranges. The role of fire is to maintain open stands of ponderosa pine.	Patterns are within historical ranges. (corridors are present and functional.) Role of fire is to maintain open stands of ponderosa pine.	Patterns are within historical ranges. (Pattern sizes, shapes and corridors are maintaining processes.) Periodic fires create uneven-aged stands composed of various even-aged groups.

SUBJECT: PINYON - JUNIPER (*Pinus edulis or P. monophylla* with *Juniperus osteosperma*)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages.	40% is Mature and Old.	Balanced Range: Grass/forb ≈10% Seedling/Sapling ≈10% Young Forest ≈20% Mid Aged Forest ≈20% Mature Forest ≈20% Old Forest ≈20%
COMPOSITION	Pinyon - Juniper are dominant.	Forbs, grasses and shrubs are resilient.	Shrub, forb and grass composition make up 20% or more of total vegetation. Bare ground less than 20%. Rock cover is common.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insect and disease populations cause less than 10% mortality in host type. <40% have dwarf or true mistletoe. < 5% have black stain fungus. Fire regimes are within historical ranges. The fire return interval is 10 to 30 years.	Endemic insect and disease populations cause less than 10% mortality in host type. <30% have dwarf or true mistletoe. < 5% have black stain fungus. Fire regimes are within historical ranges. The fire return interval is 10 to 30 years.	Endemic insect and disease populations. Fires burning every 10 to 30 years prevent pinyon-juniper stands from spreading into neighboring grasslands/shrublands.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns are within historical ranges. Fire maintains open (sparse) stands of pinyon-juniper and limits the spread of pinyon-juniper into other vegetation types.	Patterns are within historical ranges. (corridors are present and functional.) Fire maintains open (sparse) stands of pinyon-juniper and limits the spread of pinyon-juniper into other vegetation types.	Patterns are within historical ranges. (Pattern sizes, shapes and corridors are maintaining processes.) Pinyon - Juniper is primarily limited to habitats which offer protection from fire such as bare ridgetops and rock outcrops.

SUBJECT: MOUNTAIN MAHOGANY (*Cercocarpus* spp.)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages, sizes and ages of individual shrubs. >35% annual leader growth is retained each year to assure flowering and seed set.	Balanced range of structural stages, sizes and ages of individual shrubs. >35% annual leader growth is retained each year to assure flowering and seed set.	Balanced Range: Grass/forb ≈ 10-20% Early seral ≈ 20-40% Mid seral ≈ 20-40% Late seral ≈ 20-40%
COMPOSITION	Herbaceous layers well developed. (i.e. 20% or more total cover.) Bare ground is less than 25% cover.	Herbaceous layers well developed. (i.e. 20% or more total cover.) Bare ground is less than 25% cover.	Herbaceous layers well developed. (i.e. 20% or more total cover.) Bare ground is less than 25%.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insects and disease affect less than 40% of the host type. 50-70 year fire cycles with a mixed severity/lethal fire regime.	Endemic insects and disease affect less than 30% of the host type. 50-70 year fire cycles with a mixed severity/lethal fire regime.	Endemic insects and disease and weather affect less than 20% of the host type. Insect defoliation <50% on individual plants for 3+ years. 50-70 year fire cycles with a mixed severity/lethal regime.
PATTERNS (e.g. connectivity, shapes, size, distribution)	20-40% of acres are in mid-seral or later structural stages in patches of >25 acres. Pattern is a more or less heterogenous mosaic of structural classes.	20-40% of acres are in mid-seral or later structural stages in patches of >25 acres. Pattern is a more or less heterogenous mosaic of structural classes.	20-40% of acres are in mid-seral or later structural stages in patches of >25 acres. Pattern is a more or less heterogenous mosaic of structural classes.

SUBJECT: GAMBLE OAK (*Quercus gambelii*)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of size and age classes.	Balanced range of size and age classes.	Balanced Range: Grass/forb ≈ 10-20% Early seral ≈ 20-40% Mid seral ≈ 20-40% Late seral ≈ 20-40%
COMPOSITION	Herbaceous layers well developed. (i.e. 25% or more total herb cover.) < 10% composition of maple species.	Herbaceous layers well developed and distributed. Less than 10% of tree strata is made up of *Acer, Pinus, Pseudotsuga,* or *Abies* species.	Herbaceous layers well developed and distributed, bare ground is less than 20%. Less than 10% of tree strata is made up of *Acer, Pinus, Pseudotsuga,* or *Abies* species.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insects and disease affect less than 40% of the host type. Crown fires have a 20 to 50 year interval in this mixed severity fire regime.	Endemic insects and disease affect less than 30% of the host type. Crown fires have a 20 to 50 year interval in this mixed severity fire regime.	Weather, endemic insects and disease affect less than 20% of the host type. <20% branch and clump mortality caused by insects, disease or winter mortality. <50% insect defoliation for more than 3 years. Crown fires have a 20 to 50 year interval in this mixed severity fire regime.
PATTERNS (e.g. connectivity, shapes, size, distribution)	20-40% of acres are in mid-seral or later structural stages in patches of >25 acres. Pattern is a more or less heterogenous mosaic of structural classes. Fire helps to maintain these classes.	20-40% of acres are in mid-seral or later structural stages in patches of >25 acres. Pattern is a more or less heterogenous mosaic of structural classes. Fire helps to maintain these classes.	20-40% of acres are in mid-seral or later structural stages in patches of >25 acres. Pattern is a more or less heterogenous mosaic of structural classes. Fire helps to maintain these classes.

SUBJECT: TALL FORB	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Dominated by tall forb species.	Dominant tall forb component with 50% or more composition community by tall forb species.	Minimum ground cover of 90% leading into the winter season.
COMPOSITION	Minimum of 50% composition of tall forb indicator species on suitable habitat. (e.g. *Ligusticum* spp., *Osmorhiza* spp., *Geranium* spp.)	Mosaic dominance of tall forb indicator species.	Mosaic dominance of tall forb indicator species.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Herbivory in balance with restoration of tall forb habitat. Fire regime is within historical ranges.	Demonstrated stable or upward trend in tall forb indicator species. (See Lewis, 1990 and Mueggler, 1988.) Fire regime is within historical ranges.	Demonstrated stable or upward trend in tall forb indicator species. (See Lewis, 1990 and Mueggler, 1988.) Fire regime is within historical ranges.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns within historical range on areas still suitable for Tall forb dominance.	Patterns within historical range on areas still suitable for Tall forb dominance.	Patterns within historical range on areas still suitable for Tall forb dominance.

SUBJECT: MOUNTAIN BRUSH COMPLEX	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Multiple vegetation layers.	Multiple vegetation layers with alternating vertical dominance.	Multiple vegetation layers with alternating vertical dominance.
COMPOSITION	Balanced acreages of islands and stringers within other vegetation types.	Balanced shrub/herbaceous understory components.	Alternating prominence of shrub/herbaceous components with historical disturbance regimes. Dominance of sprouting species.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Endemic insect, disease and fire regimes within historical ranges. Fire regime is mixed severity.	Insect, disease and fire intervals within 20-40 year cycles. Fire regime is mixed severity.	Insect, disease and fire intervals within 20-40 year cycles. Fire regime is mixed severity.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Interspersed island and stringers within historical ranges.	Acreages and dispersion within historical ranges.	Acreages and dispersion within historical ranges.

SUBJECT: BIG SAGEBRUSH/GRASSLAND (*Artemisa tridentata* complex)	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balanced range of structural stages.	Balanced range of structural stages. 40% of area with 15% or more crown cover (as measured by line intercept).	Balanced Range: 10% of area with 0-5% sagebrush crown cover. 50% of area with 5-15% sagebrush crown cover. 40% of area with >15% sagebrush crown cover. Bare ground less than 20%.
COMPOSITION	Big sagebrush is dominant with an understory component of grasses and forbs.	Big sagebrush is dominant on all but 0-5% of the historical habitat.	Big sagebrush is dominant on all but 0-5% of the historical habitat.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Fire has a lethal fire regime on an approximately 20 year return cycle.	Fire has a lethal fire regime on an approximately 20 year return cycle. Drier sites may have a 20 to 40 year return interval.	Fire has a lethal fire regime on an approximately 20 year return cycle. Drier sites may have a 20 to 40 year return interval.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Patterns are within the historical range.	Patterns are within the historical range.	Patterns are within the historical range.

SUBJECT: AQUATIC AND TERRESTRIAL ANIMALS	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Age-classes/ reproductive cohorts of native fish, amphibians, and terrestrial wildlife present in adequate quantities and ratios to maintain viable populations.	Physical and biological habitat features (e.g. communities, seral stages, water bodies, etc.) are adequate to maintain viable animal populations, long-term.	Physical and biological habitat features (e.g. plant communities, seral stages; large woody debris; waterbody morphology) available within annual home range, adequate to maintain viable populations, long-term.
COMPOSITION	All native, adapted species are present, in stable to increasing populations, in suitable habitats. Exotic species, diseases and their vectors do not limit, displace or reduce the long-term viability of native species.	All native, species present, stable to increasing in suitable habitats. Exotic species and diseases do not limit, displace or reduce long-term viability of native species.	Extant native species present at sustainable population levels in habitats to which they are adapted.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Historical predators, prey, foods and habitats of native species are present, and support animal populations' viability, reproductive strategy and long-term sustainability.	Disturbances to animal habitats affect only small portions (<5%?) of animals' annual range or habitats.	Habitat features adequate to sustain viable populations are available within annual ranges of animals, even after disturbance. Population levels are sustainable within historical ranges.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Migration, distribution, reproduction, and genetic diversity of animal populations facilitated/unhindered by habitat distribution or connectivity. Populations stable in historical ranges.	Migration, distribution, reproduction, and genetic diversity of animal populations facilitated/unhindered by habitat distribution or connectivity. Populations stable in historical ranges.	Animal populations exhibit genetic and reproductive integrity, without habitat or sub-population isolation or fragmentation.

SUBJECT: HYDROLOGIC REGIME	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Water quantity and distribution within ranges defined for area.	Quantity and timing of flows within normal range. Little or no evidence of stream malfunction.	Stream base level stable. Head cuts and sediment are within historical ranges. Peak flows and base flows are within historical ranges of variability.
COMPOSITION	N/A	N/A	N/A
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Peak flows, mass movements, and flooding within historical range of variation. Percent of basin altered or disturbed within the historical range of variation.	Peak flows, mass movements, and flooding within historical range of variation. Percent of sub-basin altered or disturbed within the historical range of variation.	Peak flows, mass movements, and flooding within historical range of variation. Percent of watershed altered or disturbed within the historical range of variation.
PATTERNS (e.g. connectivity, shapes, size, distribution)	N/A	Channel maintains flows sufficient to maintain diverse water dependent landscape components.	Stream flow release sustain landscape components such as wet meadow, riparian areas, springs and seeps.

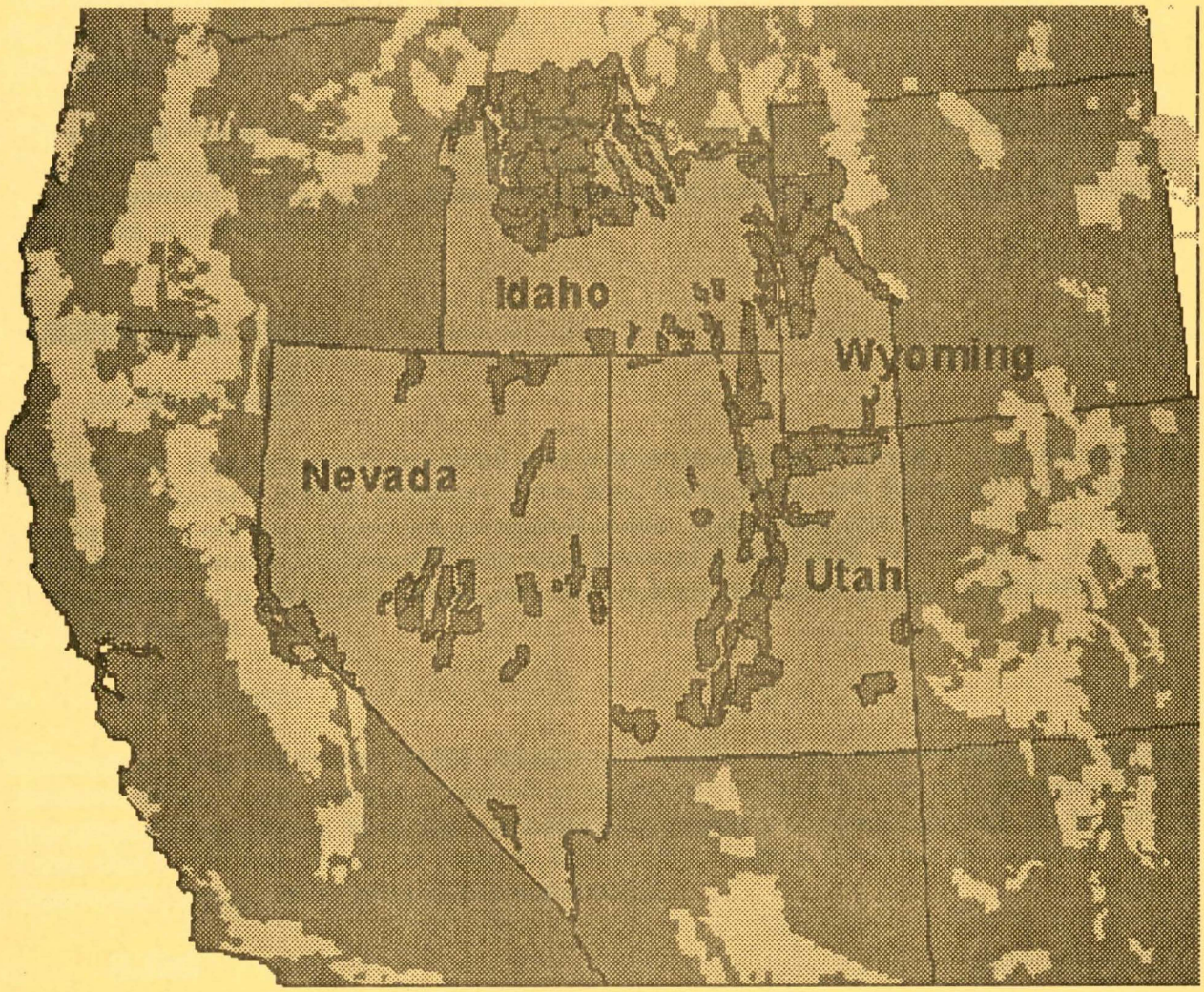
SUBJECT: SOIL QUALITY	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Amount of bare soil and soil loss within historical range of variation.	Amount of bare soil and soil loss within historical range of variation.	Absence of excessive erosion indicators such as rill/gullying and pedestaling. Intensity and area extent of soil displacement and compaction are within acceptable ranges.
COMPOSITION	Large woody material and organic matter within historical range of variation.	Large woody material and organic matter within historical range of variation.	Large woody material and organic matter within historical range of variation. (e.g. in tons/acre by cover/habitat type required for soil sustainability.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Area or extent altered or disturbed within historical range of variation.	Area or extent altered or disturbed within historical range of variation.	Area or extent altered or disturbed within historical range of variation. Infiltration and percolation ranges sustain soil hydrologic function and minimize overland flow.
PATTERNS (e.g. connectivity, shapes, size, distribution)	N/A	N/A	N/A

SUBJECT: RIPARIAN/WETLANDS	INDICATORS OF A PROPERLY FUNCTIONING CONDITION (BY GEOGRAPHIC SCALE)

CRITERIA	REGIONAL	SUBREGIONAL:	LANDSCAPE
STRUCTURE	Balance between the vegetation, soil and water resources.	Balance between the vegetation, soil and water resources.	Amount and type of vegetation community types present that maintain riparian dependent resources and provide a high rate of recovery following disturbance.
COMPOSITION	Extent and distribution of riparian and wetland areas reflective of historical ranges.	Amounts and kinds of vegetation and physical properties sustain riparian dependent resources.	The plant community type composition emphasizes hydric vegetation. Stream gradients, meanders, sediment amounts and general flow regimes are within historical range of variation.
DISTURBANCE REGIME (e.g. fire, insects, pathogens, flood, wind)	Within historical spatial and temporal disturbance patterns and recovery rates.	Rapid recovery of degraded or disturbed conditions. Frequently inundated flood plains reduce intensity of flooding.	Minimal carryover of disturbance features into the following years. Although dynamic, plant communities and hydrologic functions persist or recover rapidly.
PATTERNS (e.g. connectivity, shapes, size, distribution)	Sizes and distribution are within historical ranges.	Sizes and distribution are within historical ranges and maintain hydrologic functions.	Plant community type compositions and accompanying riparian ecosystem functions maintain proper ground water recharge, storage, delivery, water tables, channel morphology and bank stability.

DRAFT
Regional Assessment



Properly Functioning Condition

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INTERMOUNTAIN REGIONAL ASSESSMENT

Properly Function Condition (PFC)

June 3, 1996 Version

This assessment is a practical exercise to implement the use of the Properly Functioning Condition (PFC) Process developed by a Regional Team as directed by the Board of Directors on March 8, 1996. See Final Draft "Properly Functioning Condition" Phase One. The assessment was conducted to determine what is and what is not in a PFC at the Regional scale. This includes an estimate of risk in response to biological and physical attributes.

The process included an evaluation of each subject area identified in the Final Draft "Properly Functioning Condition" Phase One paper. Original team members contributed to this assessment. Each subject area was assessed at a Regional scale using the matrix developed in the final draft.

SUBJECT AREA: Alpine

A. Background

Alpine areas occupy a relatively small area within the Region. It exists at high elevations above tree line and is most common in the Wind River, Uinta, and Sawtooth mountain ranges. They are very important watershed areas. Even slight disturbance of these alpine areas is significant as recovery is very slow because of the harsh environment. Alpine areas are home to pikas, ptarmigan, and (where there are cliffs) golden eagles and peregrine falcons.

B. Assessment

Improper grazing and human traffic impacts are causing the greatest damage to vegetation on these areas. Approximately one-half of alpine areas in the Region are considered to be in a properly functioning condition. Accelerated erosion is the main concern for those areas that are at risk or are not properly functioning. Such erosion is cummulative downward through other parts of the watersheds.

C. Risk

Regionally the risk associated with this ecosystem is low. However, at the landscape level the risk can be exceptionally high. Overuse by domestic livestock and humans can increase the loss of those portions of the type still remaining in a properly functioning condition.

SUBJECT AREA: Subalpine Timberline Forests and Woodlands

A. Background

This high elevation ecosystem occurs throughout the Region, but is most important in s.w. Idaho and within the Greater Yellowstone Area. Many attributes make this a significant type, but the five-needled pines in particular are a valuable food source for wildlife (especially grizzly bear). Whitebark pine is noted for its production of relatively large seeds, which wildlife value as a food source. Whitebark pine reproduces poorly, because of harsh site conditions, sporadic seed production, low germination rates and consumption of viable seed by wildlife. Mountain pine beetle and white pine blister rust are significant agents of change affecting tree and seed viability.

B. Assessment

Most whitebark pine trees and stands are older aged. Competition with other tree species (e.g. subalpine fir), seed loss and tree mortality caused by mountain pine beetle and white pine blister rust reduce species viability. All of which, affect the ability of this tree species to regenerate. Upper timberlines dominated by limber or bristlecone pine are less important to wildlife because the pine seeds are smaller in size. However, they are subject to loss from the effects of mountain pine beetle and white pine blister rust.

C. Risk

Since these species occupy limited habitat; the risk associated with a continuing decline of species such as whitebark pine is high. Bear populations could be negatively impacted if the food source is depleted and ptarmigan populations may suffer if hiding cover is reduced.

SUBJECT AREA: Engelmann Spruce - Subalpine Fir

A. Background

This ecosystem is found primarily in southern Idaho, northwestern Wyoming, and Utah, with lesser amounts in Nevada. It ranges from pure Engelmann spruce to pure subalpine fir forests. In most instances, however, it occurs as a mixed species forest. Engelmann spruce is characterized as long-lived (>300 years), found on cool moist to wet sites or in riparian areas. It has shallow roots (susceptible to windthrow); and most stands are in a multi-canopy structural condition. It regenerates best in partial shade on bare soil microsites.

Subalpine fir is similar in ecology but is shorter-lived (100-150 years). It regenerates readily in shaded conditions on humus and duff as well as bare mineral soil. The Engelmann spruce-subalpine fir type provides elk wallow sites and habitat for many late-seral forest dependant wildlife species; such as woodpeckers and blue grouse.

Blue spruce is included in our assessment. Blue spruce is primarily in riparian and lowland areas. Some of the most extensive areas of blue spruce are on the Dixie National Forest.

B. Assessment

Structural stages are not balanced throughout the Region in this type. The majority of the type is in mature to old age classes, with few areas in seedling/sapling sized Engelmann spruce. Composition of younger stands is weighted towards subalpine fir. There is a dynamic cycle between spruce and subalpine fir dominance depending on stand conditions and insect activities. Current and recent Engelmann spruce beetle epidemics have affected extensive landscapes favoring a shift to more dominance by subalpine fir as mature spruces have been killed. On the Payette, Dixie and Manti-LaSal National Forests, spruce beetle outbreaks have resulted in spruce mortality exceeding 80 percent in many areas. Spruce beetle caused tree mortality has been above endemic levels within the Region since the mid-1980's. Much of the affected area on the Payette National Forest burned, as a result of wildfires in 1994. Stands of dense and older-aged spruce in diameter classes susceptible to spruce beetle are found on many of the National Forests in Utah, Idaho and Wyoming. Subalpine fir mortality is also at epidemic levels in the three previously listed states due to a complex of insects and disease pathogens. Extended drought in the late 80's and early 90's stressed many subalpine fir; leading to increased insect and disease activity. Subalpine fir and spruce mortality often occurs on the same stands, creating significant changes in structures and composition of the spruce/fir forests. Historically, fire regimes of mixed severity occurred on a 50 to 80 year cycle, with lethal fires every 100 to 300 years. Because of increased mortality in these older age class forests; the potential for stand replacing fires has increased. However, current conditions within the Region are within the historical range of variation for the type.

C. Risk

Potential major changes in stand structure and composition are high for this type. Changes will eventually occur as a result of large, stand-replacing fires, insect epidemics, or a combination of the two throughout much of the spruce/fir range. In addition, losses of this cover type in riparian areas may adversely affect water quality and wildlife habitat. On uplands there may also be major shifts from late-seral to early-seral forests in spruce beetle epidemic areas such as portions of the Manti-LaSal and Dixie National Forests. Closed canopy dependant wildlife such as blue grouse will be adversely affected as structures change to early-seral conditions.

SUBJECT AREA: Quaking aspen

A. Background

Quaking aspen is distributed throughout the Region with the largest concentration in eastern Idaho, western Wyoming, and Utah. As a generality, physiological age varies from 60 to 120 years. Aspen is considered an early seral species on most sites but may form an edaphic climax on others. Fire has been the most important disturbance factor influencing changes in structural stages and composition and minimizing dominance by conifer species. Non-lethal fires at lower elevations, and stand replacement fires at higher elevations, historically regenerated this species and kept these stages in balance. The fire return interval is less frequent today compared to historical averages. Quaking aspen

provides great benefit to wildlife and livestock as forage and cover. Quaking aspen maintains watershed condition, enhances soil productivity, and provides aesthetically pleasing values to people. Most previous regeneration treatments in quaking aspen have occurred at the scale of a stand. This is at a scale too small to have much benefit on quaking aspen at a landscape or larger scale.

B. Assessment

Approximately 85 percent of the quaking aspen in the Region are in a mid to late seral successional stage. Further, many areas are being dominated by conifers through plant succession thereby further reducing quaking aspen area. Approximately 41 percent of quaking aspen in portions of Idaho have succeeded to other vegetation types compared to historical conditions. In one watershed on the Targhee National Forest, 95 percent of the quaking aspen type has succeeded to other vegetative types compared to conditions in 1910. Similar decreases in quaking aspen area is occurring Region-wide. Exclusion of fire in combination with livestock grazing have contributed to this situation. Livestock grazing over the past 100 years reduced accumulations of fine fuels (shrubs and herbaceous layers), resulting in a much lower spread of fire. In most instances, aspen regeneration has not been successful throughout the Region because of heavy grazing by wild and domesticated ungulates. Previous silvicultural treatments at the stand scale have been too small to effectively maintain quaking aspen at the landscape and larger scales.

C. Risk

There is a high risk that significant acreage of this type will continue on the path of succession to other vegetation types. The Manti-LaSal National Forest estimates an average of 1000 acres of quaking aspen change to other vegetation types each year. The lack of successful regeneration over large areas increases this risk. Continuing heavy browsing pressure by ungulates on existing quaking aspen and other forage species on these sites will result in habitat degradation for all species found within this type.

SUBJECT AREA: Lodgepole Pine

A. Background

Lodgepole pine is typically an early seral tree species ranging over extensive areas of the Region. It is abundant in southcentral Idaho, southeastern Idaho, northwestern Wyoming, northern Utah and on the Bridgeport Ranger District of the Toiyabe National Forest. Lodgepole pine forests can be characterized as: generally heavily stocked, on cold sites, and in large patterns (200+ acres). Lodgepole pine readily regenerates naturally after a fire and is often found in pure stands. Lodgepole pine longevity ranges from 150 to 300 years. The type has a history of extensive management, mostly by clearcutting in areas adjacent to Yellowstone National Park and in northern Utah. The actual percentage of the type under intensive management is small. Lodgepole pine has a history of extensive mountain pine beetle epidemics at elevations generally below 9600 feet. Dwarf mistletoe is the most common disease in lodgepole pine, affecting about 45 percent of the type within the Region. This parasitic plant affects growth in older trees and causes significant

deformation and loss of branches. It causes some mortality in all age classes. Most lodgepole pine forests in the Region are in the mature and old age classes, except for recently harvested and wildfire burned areas. The historical fire regime was one of lethal, stand-replacing fires with about 150 to 300 years between fires. Meadows and ponds in this type are valuable to frogs and toads, and early seral stages are used extensively by small mammals, mule deer, nighthawks, hummingbirds, flycatchers, bluebirds and warblers.

B. Assessment

Currently there is very little balance of structural stages in the lodgepole pine type in the Region. This imbalance will continue to promote the wide swings in amplitude in the historical ranges of structural stages. Mature lodgepole pine forests in the Region have been significantly affected by mountain pine beetle epidemics. Bark beetle outbreaks have resulted in extensive mortality. Most areas of mature lodgepole pine forests are currently highly susceptible to bark beetle attack. Such widespread mortality results in conditions favorable for stand replacing wildfires or succession to late seral vegetation. The extensive areas of lodgepole pine forests on the North Slope of the Uinta Mountains are an example of a high risk landscape. In some areas of the type previous clearcutting over extensive areas has resulted in a landscape highly fragmented when compared to the historical pattern. The buffer/leave strip strategies used previously have compromised historical ecological patterns for the type. Stand patterns under clearcutting have not replicated historical patterns which tended to be larger in extent and more irregular in shape.

C. Risk

The primary short-term risk is related to structural changes in the mature age class. This age class is susceptible to large scale mortality from mountain pine beetle infestations and wildfire. As dead lodgepole stems fall to the ground over a 10 to 20 year period; travel corridors are blocked for large ungulates such as deer, elk, moose, and domestic livestock and risk of catastrophic wildfire increases. Many of these areas burn twice with about 30 years between fires. Such repeat burns have more profound effects on soils, watershed and vegetation than single burns with longer intervals between events. Long-term risks are related to large swings from mature aged forests to grass/seedling classes. These risks result from the rapid change from late-seral to early-seral conditions thereby affecting late seral dependant wildlife species. Rate changes in time and space determine the amount of risk associated with a particular landscape. Current fragmentation within some areas will pose a risk to species that are dependant on the historical pattern of stand structures and habitat sizes and shapes.

SUBJECT AREA: Grand fir/ White fir Complex

A. Background

This ecosystem is found Region-wide except for eastern Idaho and northwestern Wyoming. Site conditions vary from very dry white fir sites in southern Utah to very moist grand fir types in Idaho. Moist sites in Idaho are among the most productive forest sites in the

Region in terms of biomass. These true fir species regenerate readily in the shade of most other trees and grow well under very dense conditions. Consequently, within the Region, they are the potential climax tree species on most sites where they are found. Very dense multi-layered canopy conditions are common and provide excellent habitat and food for defoliators such as western spruce budworm and Douglas-fir tussock moth. More fire adapted seral species such as ponderosa pine, Douglas-fir, western larch, aspen, and lodgepole pine were common as a result of past fires throughout this complex. Non-lethal fires intervals of 10 to 60 years are within the historical range of disturbance to which the seral species are adapted. Current fire regimes are longer than 100 years and are more intense, resulting in stand replacing fires rather than the low intensity fires which favored the seral tree species. Wildlife inhabitants are typically animals of deep, dark, cool forests - red fox, fishers, wolverine, blue grouse, jays, woodpeckers and kinglets. Elk, mule deer, small mammals, hummingbirds and goshawk use early seral stages.

B. Assessment

The historical pattern was one where the true firs dominated relatively few stands. Most areas in the type were dominated by species favored and maintained by periodic, low intensity fires (e.g. ponderosa pine, Douglas-fir and western larch). Currently the typical stand structure and composition is multi-layered; comprised primarily of true firs and dominated by mature and overmature age/size classes. This is a result of a combination of fire exclusion, selective harvest of large seral species and natural succession processes. Insect outbreaks such as tussock moth and western spruce budworm have caused significant amounts of tree mortality over large forested landscapes. Fir engraver populations have reached outbreak proportions on the Toiyabe and Uinta National Forests. Lack of historically frequent, low intensity fire during last 100 years sets the stage for very intense, stand replacing fires. Grand fir and white fir are adapted climatically to some sites that were historically dominated by Douglas-fir and/or ponderosa pine because the true firs are very sensitive to even frequent low intensity fires and the seral species are favored by such fires. In the absence of low-intensity fires; grand fir and white fir increase in amount and density leading to eventual dominance by the true firs.

C. Risk

The risk in this ecosystem Regionally is high for stand-replacing wildfires with an associated loss of wildlife habitat for some species. Long-term watershed risks are lower than in some other systems, because these sites are more readily revegetated. Of greater concern is the slow but certain loss to advancing plant succession of early-seral tree species and associated grasses, forbs, and shrubs that sustain diverse wildlife habitats.

SUBJECT AREA: Interior Douglas-fir

A. Background

Douglas-fir is widespread throughout Utah, southern Idaho and northwestern Wyoming with lesser amounts in Nevada. Douglas-fir vegetation ranges from adjoining ponderosa pine or even sagebrush types at lower elevations to true firs and spruces at high

elevations. Site conditions are warm and dry at lower elevations to cooler and more mesic at higher elevations. The species is adapted to a wide variation of site, climate, and soil conditions. Historical stand structures were primarily even-aged, single-canopy stands. Douglas-fir is associated with a variety of insects and diseases including: Douglas-fir beetle, Douglas-fir tussock moth and dwarf mistletoe. Fire regimes were usually non-lethal at frequencies of 10 to 25 years on dry sites, and 30 to 50 years on cooler/wetter sites. This ecosystem provides nesting and foraging sites for goshawks, spotted owls, elk and mule deer.

B. Assessment

Current structures are typified by mid- to mature age/size classes, with limited amounts of old growth trees. This small proportion of old growth is due to insect and disease epidemics and past harvest practices. Relatively few areas are in the seedling and sapling structural stage. Because Douglas-fir often grows on steep terrain; management activities may be limited. The Targhee N. F. has some of the more accessible sites within the Region. Forest succession in the absence of fire has allowed growth of true firs into areas that historically were dominated by Douglas-fir in Idaho and Utah. At higher elevations in eastern Idaho and northwestern Wyoming, Douglas-fir stands are often dense and lack the true firs commonly found on warmer sites in Idaho and Utah. Fire regimes in the type now average 100 years between fires with increasing susceptibility to stand replacement fires. Ladder fuels exist where plant succession has led to dense regeneration of Douglas-fir and true firs under existing canopies. Douglas-fir beetle is currently at epidemic levels on some sites in south central Idaho and in central Utah; but remains at endemic levels throughout most of the rest of the Region. The largest Douglas-fir tussock moth outbreak within the Region occurred in 1992, when over 420,000 acres of defoliation was recorded. Sites with three or more consecutive years of defoliation experience significant amounts of mortality.

C. Risk

The most significant risk is associated with fire; particularly where ladder fuels exist or are developing. Stand replacement fires, outside of historical ranges of intensity and size, are likely. Insect populations are primarily at endemic levels within the type. Sites become more susceptible to Douglas-fir tussock moth defoliation, as stand densities and proportion of grand fir increase through time. Risk to Douglas-fir beetle increases as tree and stand densities increase. Disturbances caused by defoliation or windthrow and extended periods of drought also increase tree susceptibility to bark beetles in older, dense stands of Douglas-fir. Approximately one-third of the Douglas-fir type within the Region is affected by dwarf mistletoe. In some areas, levels of infection are moderate to high affecting viability of the trees. Potential loss or reduction of habitat conditions for late-seral dependant wildlife species is high. A post-fire increase in herbaceous vegetation may temporarily improve habitat for ungulates such as elk, deer and domestic livestock. The historical balance of patterns and structures will be compromised by large stand-replacing fires, or continued exclusion of frequent non-lethal fires. Such unbalanced patterns provide poor habitat for the suite of animal and plant species which historically inhabited this forest type. In addition to unplanned vegetation changes; more intense disturbances have significant negative effects on soil and water quality.

SUBJECT AREA: Ponderosa Pine/ Jeffrey Pine complex

A. Background

This ecosystem is found mainly in southern Idaho on the Boise, Payette, Sawtooth, Challis, and Salmon National Forests. Jeffrey pine in the Region is limited to the Sierra Mountains in western Nevada (Reno/Tahoe). Historical structures were predominately multi-canopy, lightly to moderately stocked, and dominated by ponderosa pine/Jeffrey pine. Current structural conditions are mainly mid- to mature-aged classes, with small amounts of old growth and seedling /sapling size classes. Historically, the fire regimes were typically non-lethal and at intervals of 5-25 years. Some of the best goshawk and flammulated owl habitat was in these savannah forests.

Past management in the 60's, 70's, and 80s' simplified many of the structural conditions resulting in a more even-aged single canopy structure. On the Boise NF extensive stands of pure ponderosa pine are common in areas planted after the wildfires of the last four decades. Past management focused on removal of large overmature trees further simplifying ecosystem structure.

In the Sierra Front, the "Comstock" mining era led to the removal of the majority of mid to older aged Jeffrey pine. These sites currently consist primarily of 80 to 100 year old even-age Jeffrey pine at densities beyond site potential for sustainability. California spotted owls utilize this habitat for foraging.

B. Assessment

Current structures are dominated by overstocked, mid- to mature-aged, and old size/age classes. Successional processes in the absence of frequent fires or other disturbances (i.e. timber harvest) has let to the ingrowth of more shade tolerant late seral species such as Douglas-fir and true firs on sites historically dominated by ponderosa /Jeffrey pine. Fuel ladders from layered vegetation add to the risk of catastrophic fires. The majority of the larger young plantations on the Boise N.F. are considered a high wildfire risk. Currently, insect populations are at endemic levels in southern Idaho. Regionally, dwarf mistletoe affects approximately one-fourth of the ponderosa pine type. Current fire regimes include larger more intense fires (50,000-300,000 acres), especially in the last ten years. The historical fire regime of smaller, less damaging fires, is not occurring in this cover type. The soils are primarily granitic which are highly erosive when disturbed. Previous roading and extensive burned areas are delivering significant amounts of sediment in waterways thereby degrading fish habitat in major streams and rivers.

Jeffrey pine beetle populations remain at epidemic levels on some sites on the Toiyabe N.F., resulting in significant mortality of Jeffrey pine within the affected areas. Jeffrey pine beetle populations have increased significantly on the California side of the Regional border, with the heavy populations found in the Lake Tahoe area affecting larger landscapes.

C. Risk

A high risk exists for losing significant acreages of the type to catastrophic wildfires similar to those during the last few years. This actual and potential loss decreases habitat for late-seral vegetation dependent wildlife species. A post-fire increase in herbaceous plants improves habitat for ungulates such as deer and domestic livestock. The historical balance of landscape patterns and vertical structures is compromised by large stand-replacing fires, or the continued exclusion of frequent non-lethal fires. Loss of ponderosa/Jeffrey pine to late seral species such as Douglas-fir and white fir results in a net loss of ponderosa/Jeffrey pine habitat. Such unbalanced patterns provide poor habitat for the suite of animal and plant species which have historically inhabited this ecosystem. This impact could be greatest on goshawk. In addition to unplanned vegetation changes; more intense disturbance events have significant negative effects on soil and water quality.

SUBJECT AREA: Ponderosa Pine (Southern Utah) type

A. Background

This ecosystem is found on the Ashley, Dixie, Manti-LaSal, and Fishlake National Forests within the Intermountain Region. Tree species composition and the complex of associated insects are different from the ponderosa pine in southern Idaho. In southern Utah this type is found between Gambel oak/sagebrush at lower elevations and mixed conifers (Douglas-fir and white fir) at higher elevations. Structures are normally multilayered with a range of tree sizes. The climate is warm and dry with annual precipitation of 16 to 24 inches. Historical fire regimes include non-lethal fires at intervals of 5 to 25 years. Some of the best goshawk, flammulated owl and wild turkey habitat in the Region occurred in these savanna forests. Mexican spotted owl utilizes this habitat for foraging.

B. Assessment

Exclusion of frequent non-lethal fires has allowed much of this cover type to progress to latter successional stages. Structures are predominantly made up of larger trees in the mid- to mature-aged classes, and are overly dense. Composition in some areas now includes a much higher proportion of late seral tree species such as Douglas-fir, or white fir. Early seral species such as aspen are poorly represented. The effects of harvesting in the 60's and 70's, which created open stand conditions are now declining, particularly in the Monticello unit of the Manti-LaSal National Forest.

Overly dense stands create conditions leading to a major mountain pine beetle epidemic. Tree mortality has increased over the last six years resulting in pockets of mortality at times exceeding 500 trees. This epidemic is expected to increase in size and intensity. Regionally, dwarf mistletoe affects approximately one-fourth of the ponderosa pine type.

Fires have not been active in these areas for the last 100 years, adding to the density and ingrowth of late-seral tree species (e.g. Douglas-fir and white fir). Ladder fuels are well developed and contribute to wildfires outside of the historical range in intensity and size. In addition to ladder fuels, there is a build up of forest litter increasing potential fire hazard

and lethal effects of fires on vegetation by concentrating heat on the upper soil layers and around the stems of trees and shrubs.

C. Risk

The risk is high in this cover type for losing significant acreages to catastrophic wildfires similar to recent fire activity on the Dixie and Manti-LaSal National Forests. This actual and potential loss will cause a reduction in habitat conditions suitable for late-seral dependent wildlife species. A post-fire increase in grass/forbs may improve habitat for ungulates such as deer and domestic livestock. The historical balance of patterns and structures within the ecosystem may be compromised by large stand-replacing fires, and/or the continued exclusion of low intensity fires (which favor ponderosa pine regeneration and dominance). Replacement of ponderosa pine by more competitive late seral species such as Douglas-fir and white fir results in a net loss of ponderosa pine forest. Such vegetation patterns outside the historical range of conditions provide poorer habitat for the suite of animal and plant species which historically inhabited such ponderosa pine forests. This impact could be greatest on goshawk and Mexican spotted owl.

SUBJECT AREA: Pinyon-Juniper

A. Background

Pinyon pine is generally more abundant in stands at moderate elevations; while at lower elevations, juniper dominates most sites. There are three juniper species in the Region: Western juniper, Utah juniper, and Rocky Mountain juniper. Western juniper is found in northern Nevada and western Idaho, accounting for a small percentage of the juniper type in the Intermountain Region. Utah and Rocky Mountain junipers are widespread throughout the Region.

Utah juniper grows on relatively dry sites with an annual precipitation of 10-15 inches. It does not sprout after fire. Its distribution and density has increased at lower elevations due to grazing and lack of fire, allowing it to occupy areas with deeper soils. As it increases on these sites; it displaces sagebrush and mountain brush cover types. Utah Juniper is a surface feeder with a shallow, spreading root system making it highly competitive with other plants. Pinyon pine becomes more abundant on sites where annual precipitation exceeds 18 inches. This habitat is very important to many wildlife species such as some salamanders, lizards, small snakes, mule deer, spotted owls, swallows, ravens, bluebirds, kinglets, and insectivorous warblers.

Rocky Mountain juniper is found on somewhat more moist sites than Utah juniper with 18-20 inches of annual precipitation. Its range has not expanded as extensively as Utah juniper. This juniper is characterized by a heavy seed, high water use, and limited value to ungulates for browse. Expansion of its range to lower elevations is limited by drought; expansion into more mesic sites is limited by competition with more competitive coniferous forest species.

B. Assessment

Utah juniper currently exceeds its historical range by as much as 60 percent. Fire return intervals have increased compared to historical patterns. Erosion rates are accelerated because there is little understory vegetation to help retain the soil in the overmature stands of juniper. Balance of structural stages is strongly weighted to mature and overmature stands. This stand structure is not considered a properly functioning condition.

Rocky Mountain juniper is typically found between conifer forest and sagebrush vegetation types and has not significantly increased in area but has increased in density. The grass/forb component in overmature and dense stands of juniper is significantly reduced. Watershed conditions are deteriorating due to the lack of soil cover and as a result of competition for available moisture by an increase in juniper plants. Loss of native grass and forb cover decreases the acreages of wildfires due to lack of fine fuels necessary to carry fire. The number of fire starts are approximately the same as in historical times but the extent of the fires is much reduced. These historical fires regulated the distribution of pinyon-juniper and the overstory/understory ratios.

The majority of insect and disease activity is endemic, although on some sites abundant activity can be observed. Dwarf and true mistletoe are widespread throughout the pinyon-juniper cover type. Pockets of black stain and Pinyon ips bark beetle vary throughout the range of pinyon-juniper with some areas having abundant black stain and Pinyon ips bark beetle activity.

C. Risk

The risk associated with this cover type is high because of accelerated erosion caused by reduced herbaceous ground cover. The area affected is significant throughout the Region. Unbalanced structure, composition, and pattern are indicators of improperly functioning conditions, and diminishing value as wildlife habitat.

SUBJECT AREA: Mountain Mahogany

A. Background

There are two major mountain mahogany species found within the Region, curl-leaf mountain mahogany and birch leaf mountain mahogany. To evaluate risk and develop management strategies, resource specialists must understand the differences between these species. Both species are highly desired forage by wildlife and livestock. The south or west slopes common in the type and the nutritious forage provided by the mountain mahoganies make these sites highly important winter ranges for wildlife.

Birch leaf mountain mahogany is deciduous and sprouts following fires. It is typically found on calcareous parent materials. It is very resilient to use and disturbance events and it tolerates extended periods of drought.

Curl-leaf mountain mahogany is evergreen, has a tree like form, and has a number of disease pathogens. It is also often found on calcareous substrates but may grow on other substrates as well. Because it does not resprout after burning and reproduces by only

seed; it has been difficult to regenerate. Wildfires have killed some areas of curl-leaf mountain mahogany resulting in sites that are difficult to regenerate. Many stands of curl-leaf mountain mahogany have been heavily browsed resulting in a "highlined" condition. Birch leaf mountain mahogany has also declined in cover as a result of heavy browsing pressure by domestic and wild ungulates with concomitant increase in bare soil. Use by large ungulates such as elk, deer, bighorn sheep and moose is high.

B. Assessment

Curl-leaf mountain mahogany has been heavily browsed throughout the Region as evidenced by the "highlined" condition. This species is primarily in an old structural condition and not successfully regenerating. The heaviest losses of this component are on dry southern slopes and at lower-moderate elevations where the type is found. Livestock, ungulate wildlife and small mammals are adversely affecting this species ability to regenerate. Its large seed is a preferred food of rodents, further impacting regeneration. Overgrazing by ungulates is reducing ground cover and degrading general watershed conditions.

Birch leaf mahogany has an advantage regenerating, since it resprouts after fire or browsing. However, this species continues to decline due to excessive ungulate use. Vegetative cover on south slopes has been reduced by an estimated one-third in some areas during the last 30 years. On these sites, higher amounts of bare soil are now present. Although this species remains in good condition on north facing slopes, the continued loss of this species on south aspects will eventually lead to a decline on north aspects as ungulates search for available food sources.

C. Risk

The risk remains high for a continued decline of both mountain mahogany species. Importance as a valuable forage for native wildlife increases their value. Most populations are decadent and regeneration is not keeping up with mortality. Old age and inadequate reproduction of existing plants constitute a risk of losing the type altogether in some places. Bare ground increases as vegetation is lost, and watershed values are adversely affected. The most severe loss of birch leaf mountain mahogany is occurring on southerly aspects of its range. Continued heavy use by ungulates will prevent regeneration, causing significant loss of soil and watershed values.

SUBJECT AREA: Gambel Oak

A. Background

Distribution of oak is primarily limited to foothills in eastern and southern Utah. This prolific sprouter occurs in extensive stands throughout its range. On better sites, oak exists in tree form. Today the range of Gambel oak is estimated to be greater than it was historically. Gambel oak provides good watershed protection because it holds the soil in place by its massive root system. It also supports abundant understory grass and forb cover unless it becomes so dense that species are shaded out. "Scrubby" Gambel oak is

valuable habitat for some salamanders and lizards, small snakes, mule deer, Swainson's hawk, owls, swallows, ravens, warblers and finches. With pines in parts of southern Utah, Gambel oak is a component of Mexican spotted owl habitat.

B. Assessment

The Gambel oak type is in moderate to excellent condition throughout its range. Fire intervals may be slightly longer than historical averages, but Gambel oak stand structures and conditions are sustained and viable. Some habitat has been lost to residential encroachment in the foothill areas. A variety of insects are commonly associated with the oak type; however, none of the native insect species pose a threat to the oak resource. Most detrimental effects are temporary and are the result of fire or weather (frost). Since it is a prolific sprouter; recovery of oak communities is often rapid. Existing watershed conditions and recycling of nutrients within oak sites is favorable and its value to wildlife seems undiminished. Additional study of the oak component is necessary to fully understand the interactions occurring within this type.

C. Risk

The majority of this vegetative type is not presently at risk within the Region, except for areas where residential incroachment is occurring. One primary concern is the fire hazard this type may present to humans within urban interface areas.

SUBJECT AREA: Tall Forb

A. Background

This cover type is considered the "flower garden" of the mountains. Historically, tall forb types were common throughout the mountains of Utah, western Colorado, western Wyoming, southern Montana, and southeastern Idaho at elevations above 7,000 feet, and in precipitation zones where annual precipitation is greater than 35 inches. These sites are characterized as having a wide variation of deep, well-drained productive soils. Forbs are the dominant vegetation. Tall forb mountain meadows are valuable to elk, eagles, owls, humming birds, swallows and many small mammals.

B. Assessment

Approximately 50 percent of this type was lost years ago due to improper grazing; which caused a significant loss of the deep, rich soils. Many sites are presently dominated by tarweed and mountain coneflower. Site restoration is very difficult, or nearly impossible, because most of the loamy soils are gone. At best, it will require a long time interval or expensive efforts to restore these sites to their historical condition.

C. Risk

The remaining 50 percent of the tall forb community is at extreme risk if current grazing practices continue to degrade its composition and structure. Loss of these sites to conifer

encroachment is also possible. Because flower production is adversely affected when these tall forbs are lost, some sensitive, disjunct or isolated colonies of butterflies are also at risk of disappearing. Protecting this easily lost cover type is important because less than half of the original acreage is still in a properly functioning condition, and rehabilitation is often impractical.

SUBJECT AREA: Mountain Brush Complex

A. Background

The mountain brush community is a complex of several different species but they share some common chacteristics. The complex has slightly higher moisture regimes than does sagebrush, with an annual precipitation of 15 to 20 inches. Common shrub species include: chokecherry, bittercherry, service berry, mountain snowberry, mountain maple, and elderberry. Each of these species resprout after fires. This cover type is found intermingled with sagebrush at mid elevations and conifer/aspen forests at higher elevations.

B. Assessment

The range of mountain brush has been shrinking, due to longer fire intervals and overgrazing by ungulates. Wherever this vegetative type is found on south facing slopes and is used as winter range; its extent and condition continues to decline. On north slopes, the type is generally in good condition. Mountain maple has been an exception, increasing in some areas of the Wasatch, Caribou and Targhee National Forests and especially in northern Utah. Many mountain maple areas are so dense, herbaceous cover is reduced.

C. **Risk**

This cover type is not large throughout the Region; however, locally its significance can be great. Loss of berry production, reduced grass cover, and an increase in diseases will adversely effect its potential value to a wide variety of wildlife and livestock. Wherever mountain brush declines, protection of soil resources is also reduced.

SUBJECT AREA: Big Sagebrush/Grasslands

A. Background

There are two major subspecies of big sagebrush in the Region: Wyoming big sagebrush and mountain big sagebrush. Wyoming big sagebrush occurs on a relatively small proportion of National Forest lands. This species is found in precipitation zones averaging 8-11 inches per year in the Intermountain West. Wyoming big sagebrush is commonly found in the Lemhi Mountain Range on the Salmon/Challis and Targhee National Forests, and in the Curlew National Grasslands on the Caribou NF. Historically, lethal wildfires occurred at approximately 40 year intervals. Sagebrush successfully reseeds after fire

unless fire intervals are short enough to interrupt seed production.

Mountain big sagebrush is the most common species throughout the Region. Annual precipitation in this type is 12-15 inches with a fire frequency of 20 years. Fire is normally lethal to plants but rapid regeneration occurs as a result of natural seeding. Vegetation patterns are usually patchy with several age classes represented within any one geographical setting.

B. Assessment

Most big sagebrush stands are currently outside a balanced range of structural classes. Most of the type presently occurs as mature plants in sites with more than 15 percent sagebrush cover and greater than 20 percent bare mineral soil exposed. These types and conditions have significantly increased within the Region in the last 100 years, due to grazing practices and fire exclusion. The grass and forb understory on these sites is diminishing because of grazing in combination with the increase in overstory sagebrush (>15 percent). As a result of this loss in understory vegetation, soil stability and productivity may also be seriously affected. Overland flow as a result of rain, is causing surface soil erosion and deposition in other cover types, i.e. riparian areas. Additionally, transpirational losses are occurring due to the dense sagebrush canopies. This reduces underground recharge of soil water in adjacent types, especially riparian areas.

C. Risks

The risk of soil loss and subsequent damage to sites is high across the range of mountain big sagebrush. Significant habitat loss for several avian species exists under current conditions. In the last 30 years, breeding bird counts for Brewer's Sparrow have declined at an annual rate of 6.3 percent; horned lark has decreased by 4.8 percent annually; and grasshopper sparrow counts in this habitat have declined by 18 percent per year. This habitat is experiencing the second most critical habitat loss for songbirds identified by wildlife specialists; after the critical habitat loss in riparian sites. Currently the majority of the big sagebrush complex is not in a properly functioning condition.

SUBJECT AREA: Riparian and Wetlands

A. Background

Riparian sites characteristically occupy a small amount of National Forest System land base; but they are highly productive and heavily utilized by people and animals. Populations of newts, salamanders, frogs, toads, turtles, small snakes, shrews, bats, beaver, weasels, otter, wood duck, Cooper's hawk, small owls, flycatchers, swallows, dipper, wrens, thrushes, warblers, orioles and sparrows use this restricted habitat.

Some riparian cover types have disappeared because of overuse and abuse by humans and animals. Water diversion, roads, timber harvest, grazing, and trampling have been major causes of negative impacts on riparian ecosystems. Riparian areas are indicators of

watershed conditions.

B. Assessment

Riparian areas throughout the Region have been significantly affected over the past several decades. Most of these effects have been negative, including: lowering of water tables, erosion of stream channels, exotic plant encroachment (e.g. tamarisk), removal of beaver populations, concentrated runoff and increased sediment from road construction, and changes in vegetation composition. All have contributed to degradation of riparian areas.

Riparian problems begin at higher elevations on steeper slopes, and gradually increase with decreasing elevation and slope. Some riparian zones suffer from loss of soil-holding vegetation; restoring native riparian vegetation would provide shade, cover, and soil protection, which would improve water quality and wildlife habitat. Other sites have too much vegetation -- interruption of historic disturbance patterns and several decades of reduced flows have led to cottonwood recruitment and many overmature Populus species on some sites. These stream courses have experienced reduced flows, or have even quit flowing. Populations of several species of frogs, bats, and birds (sandhill crane, yellow warbler, Brewer's blackbird, killdeer, northern rough-winged swallow, Wilson's phalarope, and common yellowthroat) are declining significantly, in part due to diminishing riparian habitat.

C. Risk

Risk increases annually, due to a variety of impacts within riparian sites: degradation of water quality, soil stability, and wildlife habitat, and increasing human disturbances. This is the **most** important ecosystem component in the Region that is currently outside properly functioning condition.

REGIONAL SUMMARY OF PROPERLY FUNCTIONING CONDITION

After the team completed the assessment by subject areas they were ranked to reflect the relative risk to PFC at a Regional Scale. The relative risk rating of low, moderate and high is an indication of how much departure there may be below the properly functioning condition. These rankings only apply to biological and physical attributes and do not reflect management priorities when social expectations are factored in.

High Risk

Riparian/Wetland
Quaking Aspen
Big sagebrush/Grassland
Pinyon-Juniper
Tall Forb
Engelmann spruce-subalpine fir
Grand fir/white fir

Moderate Risk

Ponderosa pine/Jeffrey pine
Ponderosa pine Southern Utah Type
Douglas-fir
Lodgepole pine
Mountain mahogany
Subalpine timberline forests and woodlands

Low Risk

Mountain brush
Gambel oak
Alpine

Properly Functioning Condition Assessment

Utah High Plateaus and Mountains Section

DRAFT

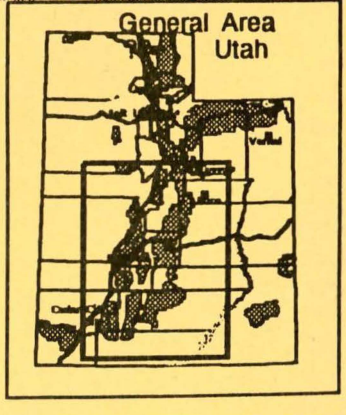
0 12 24 36 48 Miles

Legend

- Cities
- Study Area Boundary
- Forest Boundary

Roads

- Interstate
- Other U.S. highway
- Other state primary highway



INTERMOUNTAIN SUB-REGIONAL ASSESSMENT

Properly Function Condition (PFC)

July 17, 1996 Version

DRAFT

This assessment is a practical application of the process for assessing Proper Functioning Condition at a Sub-Regional scale. This process was first developed and tested at a Regional scale. See "Properly Functioning Condition" Process Draft of August 12, 1996.

This Sub-Regional Assessment covers portions of the Southern Utah Ecogroup including much but not all of the Manti-LaSal and Dixie National Forests and essentially all of the Fishlake National Forest. The Sub-Region included in the assessment includes all of the Utah High Plateaus and Mountains Section (M341C) from:

> "Ecological Subregions of the United States: Section Descriptions". Compiled by W. Henry McNab and Peter E. Avers. July 1994. United States Department of Agriculture, Forest Service, Ecosystem Management, Washington, DC.

Additionally 2 (draft) subsections from the Bonneville Basin Section (341A); the Gunnison Plateau (341A-14) and the Canyon Mountain Range (341A-17) were included to include valley areas within the Sub-Region. Subsection descriptions are drafts and have not yet been formally adopted. See Figure 1 for a map of the Section and Subsections.

This report is the discussion of subject areas covered in the assessment and includes an estimate of risk to biological and physical attributes. It is based on assessment team meetings held in Ogden, Utah on June 24-26, 1996. The team consisted of:

> Jack Amundson, Team Leader and Regional Silviculturist, Vegetation Management
> Alma H. Winward, Regional Ecologist, Vegetation Management
> Thomas M. Collins, Regional Soil Scientist, Biophysical Resources
> David Newhouse, Regional Wildlife Ecologist, Biophysical Resources
> Steve Munson, Entomologist, State and Private Forestry
> Doug Myers, Inventory Specialist, Vegetation Management
> Suzanne Johnson, GIS Specialist, Information Management
> Clint Williams, Ecologist, Vegetation Management
> Karen Ogle, Fire Ecologist, Regional Office and Boise N.F.
> Bob Thompson, Range Conservationist, Manti-LaSal N.F.
> Dan Larsen, Soil Scientist, Manti-LaSal N.F.
> Brian Ferguson, Silviculturist, Dixie N.F.
> Lynn Findlay, Forester, Fishlake N.F.
> Bob Campbell, Ecologist, Fishlake N.F.
> Curtis Warrick, Resource Advisor, Richfield District, BLM

Properly Functioning Condition Assessment

Utah High Plateaus and Mountains Section

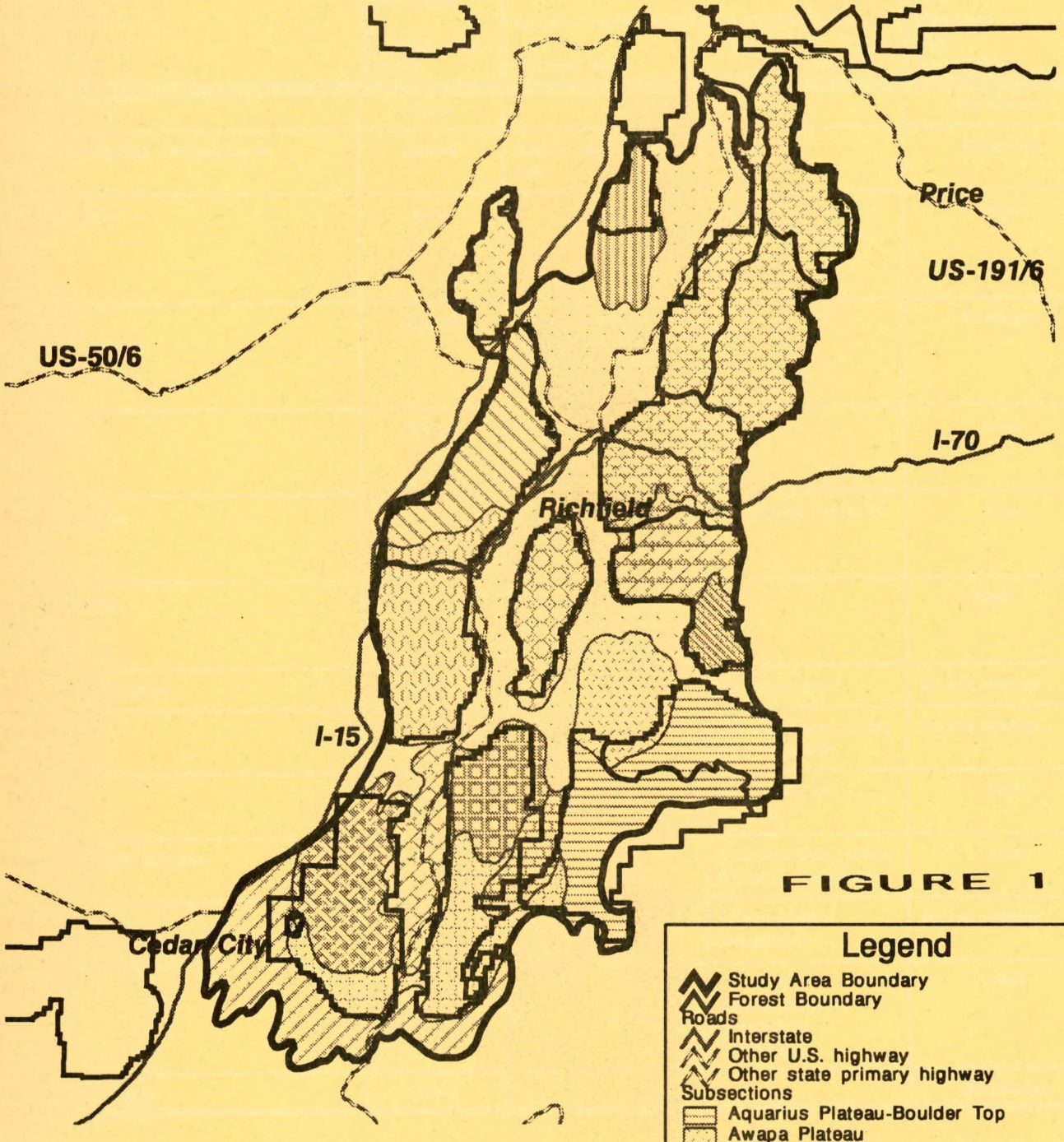


FIGURE 1

Legend

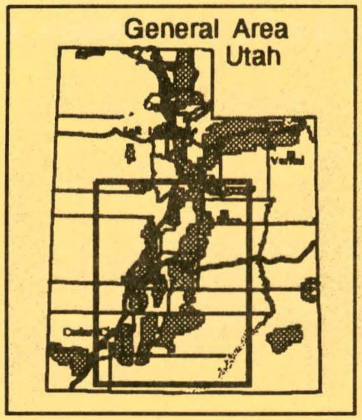
- Study Area Boundary
- Forest Boundary

Roads

- Interstate
- Other U.S. highway
- Other state primary highway

Subsections

- Aquarius Plateau-Boulder Top
- Awapa Plateau
- Canyon Mountains
- Fishlake Plateau
- Gunnison Plateau
- Johns Valley
- Monroe Mountain
- Northern Markagunt Plateau
- Pavant Range
- Sanpete - Sevier Valleys
- Sanpete, Sevier, Gunnison Valleys
- Sevier Plateau
- Southern Markagunt-Paunsaugunt Plateaus
- Southern Plateau Slopes
- Thousand Lake Mountain
- Tushar Mountains
- Upper Sevier River Valley
- Wasatch Plateau



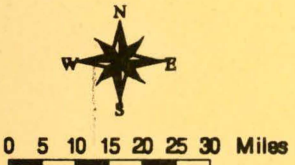


Table 1: Relative Changes in Landscape Patterns within the Sub-Region by Subject Area:*

SUBJECT AREA	NET CHANGE IN PATTERN Gained, Lost, Static	HISTORICAL RANGE (~150-400 years before present) Subject area(s) gained from or lost to: Gained from:	Lost to:	MAGNITUDE: Low Moderate High No change
Alpine	Static			No change
Engelmann Spruce - Subalpine fir	Gained	Aspen, riparian, tall forb		Moderate
Quaking aspen	Lost		Spruce-fir, Douglas-fir, ponderosa pine, white fir and sagebrush	High
White fir	Gained	Aspen, ponderosa pine, Douglas-fir, mtn. brush and riparian		Moderate
Douglas-fir	Gained	Aspen, ponderosa pine, oak and sagebrush	White fir	Low
Ponderosa pine	Lost	Riparian, aspen, sagebrush, mtn. brush	Douglas-fir, white fir	Low
Pinyon-juniper	Gained	Sagebrush, mtn. brush, oak, mtn. mahogany		High +
Mountain mahogany	~Static		Pinyon-juniper?	No net change
Gambel oak	~Static	Aspen, mtn. brush?	Pinyon-juniper, white fir, Douglas-fir	No net change
Tall forb	Lost		Spruce-fir, soil erosion	High
Mountain brush complex	Lost		Pinyon-juniper, white fir, oak?, sagebrush	Low
Sagebrush	~Static	Aspen, riparian	Pinyon-juniper, Douglas-fir	No net change
Riparian	Lost		Spruce-fir, ponderosa pine, Douglas-fir, sagebrush	High
Salt Desert Shrub	Static			No change

*Some subject areas (e.g. pinyon-juniper, sagebrush, etc.) have also increased in density. For some subject areas losses ~balanced by gains (e.g. mountain mahogany, Gambel oak, etc.).

Figure 2 is a map of the major vegetation types as developed by the GAP team at Utah State University. Table 2 is the acreage values from the same data as used to develop Figure 2. Because of scale and criteria differences; the distribution and associated acreage figures on Figure 2 and Table 2 may differ from values from other sources. For example, criteria used to define Alpine by the assessment team are more restrictive than GAP mapping so Figure 2 and Table 2 display Alpine for geographic areas where it does not exist by assessment team criteria. Riparian areas were not mapped for some subsections yet riparian is found in these subsections. Douglas-fir was lumped in mapping into the white fir community. Figure 2 and Table 2 are included to give a general overview and sense of relative proportion of some of the major types but the data are relative to the mapping criteria.

Properly Functioning Condition Assessment

Utah High Plateaus and Mountains Section

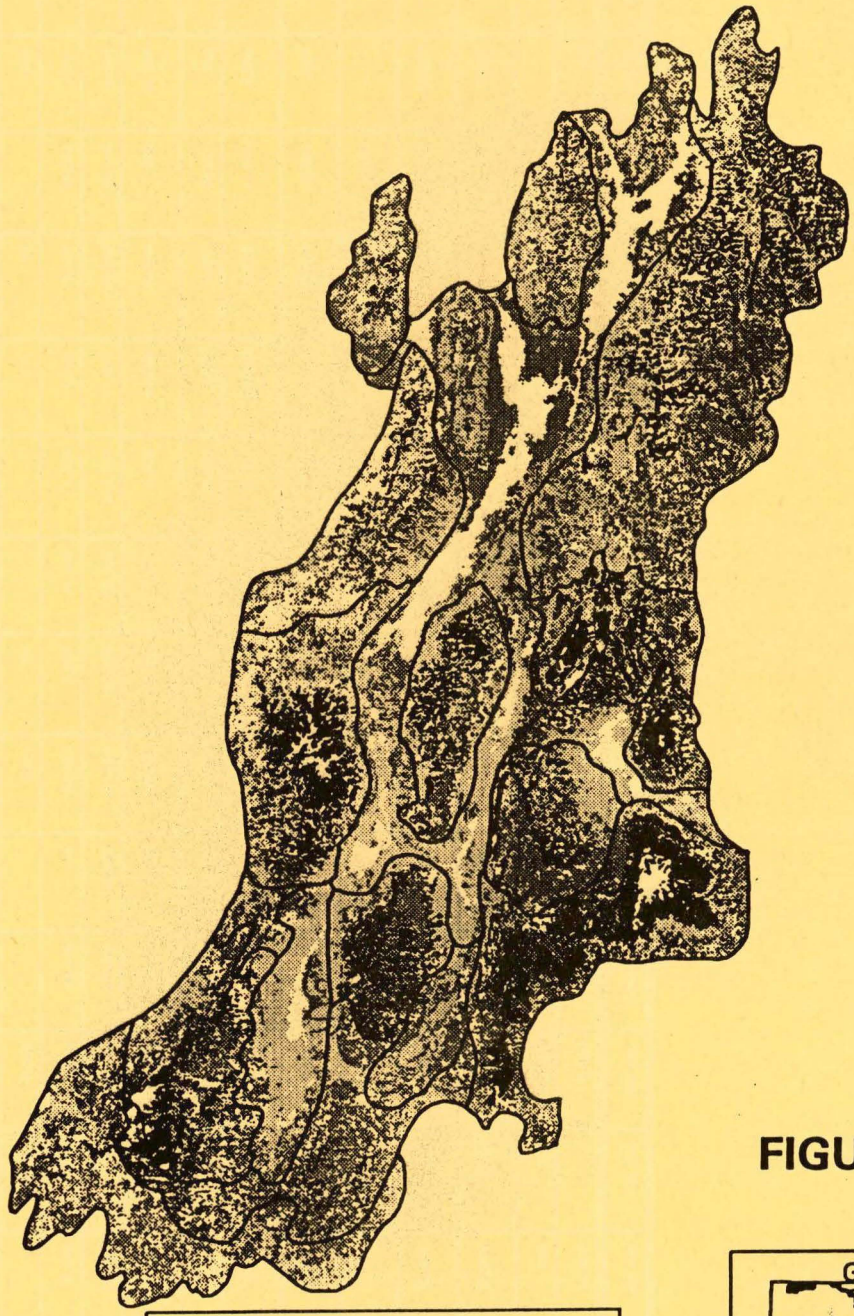
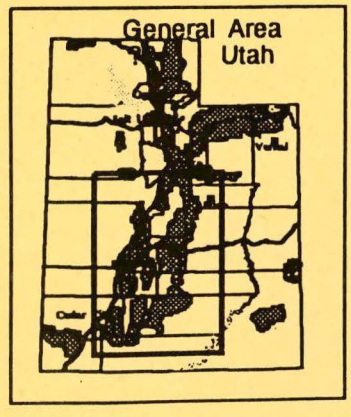


FIGURE 2



Legend

- Subsection Boundaries
- Gap Vegetation
- Aspen
- Big Sagebrush/Grassland
- Engelmann Spruce-Subalpine
- Grand Fir/White Fir Complex
- Pinyon Pine-Juniper
- Ponderosa Pine- Southern

N
W E
S

0 10 20 30 40 Miles

Table 2. Acres in Broad Vegetation Types by Geographic Subsection. 5,301,490 acres are in the Sub-Region. Percents are rounded to the nearest tenth of a percent. (Data from the GAP mapping done by Utah State University.)

SUBJECT AREA Percent of total area shown in ( ).	Aquarius Plateau-Boulder Top	Awapa Plateau	Canyon Mountains	Fishlake Plateau	Gunnison Plateau	Johns Valley	Monroe Mountain	Northern Markagunt Plateau	Pavant Range	Sanpete, Sevier, Gunnison Valleys	Sevier Plateau	Southern Markagunt-Paunsaugunt Plateau	Southern Plateau Slopes	Thousand Lake Mountain	Tushar Mountains	Upper Sevier River Valley	Wasatch Plateau
Alpine (1.1%)	27,658			6,484			1,521	22			171	58		1090	7678		14002
Aspen (10.4%)	40,643	6,200	2,091	49,434	19,426	118	33,657	5,222	41,406	4,414	1,385	3,331	25,022	4,081	46,199	85	270,729
Sagebrush (26.4%)	88,879	58,336	56,511	37,554	37,537	35,522	30,565	62,379	51,115	374,159	31,612	99,286	128,144	19,140	40,088	36,929	209,856
Engelmann Spruce - Subalpine fir (11.4%)	171,035	5,547	454	68,923	1,366	1,186	38,621	59,552	4,612	2,876	46,095	18,140	7,349	24,264	67,857	741	84,804
Gamble Oak (6.0%)	3,652	1,362	17,749	334	26,399	1,659	3,350	2,867	77,899	37,864	1,075	5,917	48,521	305	41,287	1,184	48,072
White Fir/ Douglas-fir (5.8%)	21,899	9,053	5,839	9,268	10,638	479	16,056	20,783	23,002	5,514	27,330	21,776	11,535	4,905	40,598	275	79,309
Mountain Brush complex (5.0%)	9,725	17,420	4,507	3,860	19,027	1,682	9,689	15,302	23,305	6,303	5,418	13,054	40,599	927	28,140	2,012	66,313
Mountain Mahogany (0.3%)	55		579	122	264		661	677	2,189	537	90	326	2,139		3,979		2,016
Pinyon Pine-Juniper (26.0%)	4,249	72,531	38,080	18,875	46,017	47,065	53,321	39,078	60,473	445,116	55,258	34,924	103,718	13,922	90,143	145,506	108,393
Ponderosa Pine (2.0%)	6,791	21,266	1,844	3,497		559	4,546	12,790	6,558	8,481	4,727	10,426	5,625	1,051	11,270	1,398	7,182
Riparian (0.65%)	981	134	725	2,702	358		814	615	6,137	7,543		212	1,663		2,965	38	9,611
Tall Forb (4.9%)	16,105	12,887		6,699	9,481	8,116	4,975	16,106	10,208	6,900	1,676	39,445	46,391	796	9,051	5,615	66,268
TOTALS	391,672	204,736	128,379	207,532	170,513	96,386	197,776	235,393	306,904	899,707	174,837	246,895	420,706	70,481	389,255	193,783	966,535

SUBJECT AREA: Alpine

A. Background

Alpine areas occupy a relatively small area within the Sub-Region. It exists at high elevations above tree line and is essentially restricted to the Tushar Mountains. Geologic patterns distinctive to the Tushars include extensive sliderock and shalerock areas in the alpine zone. Alpine areas have high watershed values. Even slight disturbance is significant as recovery is very slow because of the harsh environment. Alpine areas are home to pikas, and (where there are cliffs) golden eagles and peregrine falcons. The upper portions of two Research Natural Areas, Upper Fish Creek and Bullion Canyon, include some of the alpine area of the Tushar Mountains.

B. Assessment

Past mining activities and human traffic impacts have caused the greatest damage to vegetation in the Tushars. Yet, the most of the area is considered to be in a properly functioning condition, however, accelerated erosion is the main concern for those areas that are at risk. Such erosion is cummulative downward through other parts of the watersheds. Mountain goats have been recently introduced to the Tushars and the potential impact of these large ungulates on the vegetation is currently unknown. Two sensitive plant species are found in the area: Tushar paintbrush (*Castilleja parvala*) and creeping draba (*Draba sobolifera*).

C. Risk

The risk associated with this ecosystem in the Tushar Mountains is currently judged to be low. This situation is in contrast to many other alpine ares in the Region. Overuse by large ungulates and humans can quickly increase the loss of those portions of the type still remaining in a properly functioning condition, while recovery may be slow, protracted or impossible.

SUBJECT AREA: Engelmann Spruce - Subalpine Fir

A. Background

This ecosystem ranges from pure Engelmann spruce to pure subalpine fir forests. In most instances it occurs as a mixed species forest. The proportion of Engelmann spruce typically increases with elevation and on volcanic substrates. Quaking aspen is a major seral species of these forests in this Sub-Region. The Engelmann spruce-subalpine fir community provides elk wallow sites and habitat for many late-seral forest dependent wildlife species; such as woodpeckers and blue grouse.

Blue spruce is included in this subject area in our assessment. Blue spruce is found primarily in riparian and lowland areas. Some of the most extensive areas of blue spruce are on the Dixie National Forest.

On gentle slopes and plateau tops meadows are common landscape components within the area characterized by spruce-fir forests in the Sub-Region. They form a complex landscape pattern of parklands and meadows with dense conifer and aspen forests. While meadows -and upper timberline parklands are not specifically covered in the assessment; they were discussed as part of the context of spruce-fir forests and the landscape patterns inherent therein.

Engelmann spruce is characterized as long-lived tree (>300 years), found on cool moist to wet

sites or in riparian areas. Most stands are in a multi-canopy structural condition. It regenerates best in partial shade on mineral soil microsites. It has shallow roots susceptible to windthrow and is the most windthrow prone tree species in the Sub-Region. Windthrown trees often are the first step in a spruce beetle outbreak (e.g. the Aquarius Plateau in 1995). Roading and logging activities that leave too much slash or other disturbances such as landslides may also lead to spruce beetle outbreaks.

Subalpine fir is similar in ecology to Engelmann spruce but is shorter-lived (100-150 years) and less disease resistant. It regenerates more readily in shaded conditions on humus and duff as well as bare mineral soil. Because it regenerates more abundantly in duff and litter than does Engelmann spruce; subalpine fir often dominates the tree understory layer in many stands where Engelmann spruce is the overstory dominant.

B. Assessment

Structural stages are not balanced throughout the Sub-Region in this community. Areas such as the northern Markagunt Plateau, Fishlake Plateau, Thousand Lake Plateau, Wasatch Plateau and Pavant Range have mature to old age classes; with few areas in seedling/sapling sized Engelmann spruce. Spruce beetle is rapidly changing the age and structural conditions over much of the Manti-LaSal and Dixie National Forests. Some portions of the Dixie National Forest which had spruce beetle attacks in the 1920s; currently have relatively well balanced forest structures and with less current beetle activity (e.g. the Dutton Mountain area).

There is a dynamic cycle between spruce and subalpine fir dominance, depending on stand conditions and insect activities. Current and recent Engelmann spruce beetle epidemics have affected extensive landscapes, favoring a shift to more dominance by subalpine fir as mature spruces have been killed. On the Dixie and Manti-LaSal National Forests, spruce beetle outbreaks have resulted in spruce mortality exceeding 80 percent in many areas. Spruce beetle caused tree mortality has been at epidemic levels within the Sub-Region since the mid-1980's. Extended drought in the late 80's and early 90's stressed many subalpine fir; leading to increased insect and disease activity. Subalpine fir and spruce mortality often occurs in the same stands, creating significant changes in structure and composition of spruce-fir forests.

Historically, fire regimes of mixed severity occurred on a 50 to 80 year cycle, with lethal fires every 100 to 300 years. Historical fire patterns maintained aspen as a more important component of the vegetation than is possible under the current fire regime. Because of fire suppression, high stand densities and basal areas; insect activity tends to be more extensive and intense than was characteristic under historical conditions.

Livestock grazing, fire suppression and natural succession have worked together to create denser spruce-fir forests with higher accumulations of large woody debris, leading to more intense and larger fires. Such intense and extensive fires are outside the range of historical conditions. Succession of Engelmann spruce and subalpine fir into meadows and aspen communities is altering the historical patterns and proportions in the vegetation mosaic as well.

C. Risk

Potential major changes in stand structure and composition are probable for this community as a result of the late seral structure of the spruce-fir forests. Changes will eventually occur as a result of large, stand-replacing fires, insect epidemics, or a combination of the two throughout much of the spruce-fir range. Changes of extensive areas from mature and late successional spruce-fir forest to young age classes does not reflect a balance in structural conditions representative of

historical ranges. Such changes in structure and composition may result in temporary variations in water and streamflow regimes outside of historical ranges both locally and downstream. More intense and extensive fires pose greater risk to soil organic material and erosion. In addition, losses of this cover type in riparian areas may adversely affect water quality and wildlife habitat. On uplands there may also be major shifts from late-seral to early-seral forests in spruce beetle epidemic areas such as portions of the Manti-LaSal and Dixie National Forests. Epidemic outbreaks of spruce beetles are predicted to occur within the next 10-15 years on the Fishlake National Forest. Closed canopy dependent wildlife will be adversely affected as structures change to early-seral conditions.

SUBJECT AREA: Quaking aspen

A. Background

Quaking aspen is distributed throughout the Sub-Region. There is strong evidence that some if not all clones in the Sub-Region may be many thousands of years old, with regeneration restricted to vegetative suckering rather than from seed. This Sub-Region contains some of the most productive and extensive aspen forests in the western United States. As a generality, present tree ages vary from 60 to 150 years. Aspen is considered an early seral species on most sites but may form long-term seral or stable aspen stands on some sites.

Fire has been the most important disturbance factor, influencing changes in structural stages, composition and minimizing dominance by conifer species. Patchy, low-intensity fires at lower elevations, and more extensive stand replacement fires at higher elevations; historically regenerated aspen and kept these stages in balance. The fire return interval is less frequent today, compared to historical averages.

Quaking aspen provides great benefit to a variety of wildlife and livestock as forage and cover. Quaking aspen maintains watershed condition, enhances soil productivity, and is aesthetically pleasing. Most previous regeneration treatments in quaking aspen have been at the stand scale. This scale is too small to have much benefit on quaking aspen at a landscape or larger scale.

B. Assessment

Approximately 85 percent of the quaking aspen in the Sub-Region are in the mid-age, mature and old-age condition. Further, many aspen stands currently are being replaced by conifers through plant succession, thereby reducing quaking aspen area. Approximately 60 percent of quaking aspen in the Sub-Region have succeeded to conifers and 10% to sagebrush as compared to historical vegetation patterns. Exclusion of fire, in combination with ungulate grazing, has contributed to this situation. Livestock grazing over the past 140 years reduced accumulations of fine fuels (shrubs and herbaceous layers). This resulted in fewer fire starts and generally smaller fires. In most instances, aspen regeneration has not been successful in Sub-Region because of heavy grazing by wild and domesticated ungulates. Previous silvicultural treatments at the stand scale have been too small in size and limited in distribution to effectively perpetuate quaking aspen at the landscape and larger scales.

C. Risk

There is a high probability that significant acreage of this community will continue to succeed to other vegetation types. The Manti-LaSal National Forest estimates an average of 1600 acres of quaking aspen change to other vegetation types each year. The lack of successful regeneration

over large areas increases this risk. Continuing heavy browsing pressure by ungulates on existing quaking aspen and other forage species will result in habitat degradation for all species found within this type.

SUBJECT AREA: White fir

A. Background

The white fir forest community is found throughout the Sub-Region. White fir regenerates readily in the shade of most other trees and grows well under very dense conditions. Consequently, it is the potential climax tree species on most sites where it is found. Sites range from relatively moist sites with high snowfall to xeric sites at lower elevations. Very dense, multi-layered canopy conditions are common and provide excellent habitat and food for defoliators such as western spruce budworm and Douglas-fir tussock moth. Because white fir is more susceptible to diseases and insects than are associated seral species; stands dominated by white fir tend to be much more susceptible to disturbance than when sites support mainly seral species. However, on parts of the Northern Manti-LaSal National Forest, many sites historically have been dominated by white fir with little evidence of seral species.

More fire-adapted seral species such as ponderosa pine, Douglas-fir and aspen were common over the range as a result of past fires. Non-lethal fire intervals of 5 to 25 years are within the historical range of disturbance to which seral species are adapted. Intervals between fires tends to be shorter in the southern part of the Sub-Region and somewhat longer in the northern portion of the Sub-Region (e.g. Manti-LaSal National Forest). Most sites have not burned for at least 100 years. Consequently, with the accumulation of fuel, a fire today is frequently more intense, resulting in stand replacing fires rather than the low intensity fires which favored the seral tree species.

Late successional stands provide habitat for animals of deep, dark, cool forests (e.g., red fox, fisher, black bear, cougar, blue grouse, jays, woodpeckers and kinglets). Elk, mule deer, small mammals, hummingbirds and goshawks tend to prefer more open mid to early seral stages.

B. Assessment

Historically white fir dominated relatively few stands. Most areas were dominated by species favored and maintained by periodic, low intensity fires (such as ponderosa pine and Douglas-fir).

Currently typical stand structure and composition are multi-layered primarily composed of white fir and dominated by mature and old age/size classes. This is a result of a combination of fire exclusion, selective harvest of large seral species, and natural succession processes.

Insect outbreaks (such as fir engraver, tussock moth and western spruce budworm) have caused significant tree mortality over large forested landscapes. Fir engraver populations have reached outbreak proportions on the Sanpete District of the Manti-LaSal National Forest and on the Cedar City and Powell Districts of the Dixie National Forest. Root rots include annosus and armillaria root rots. Landslides have affected considerable areas on the Manti-LaSal National Forest, primarily on the North Horn geologic formation.

Lack of historically frequent, low intensity fire during last 100 years sets the stage for very intense, stand replacing fires. White fir is adapted climatically to many sites historically dominated by aspen, Douglas-fir and/or ponderosa pine. True firs are very sensitive to frequent

low intensity fires and seral species are favored by such fires. In the absence of low-intensity fires, white fir increases in numbers and density, leading to eventual dominance by white fir.

C. Risk

The risk in this ecosystem Sub-Regionally is moderate to high for stand-replacing wildfires with an associated loss of wildlife habitat for some species. Historically most sites had little white fire because of frequent, low-intensity fires. Denser stands have developed under fire control, and resulting fires tend to be more intense than historically, with subsequently greater risk to soils and watershed conditions. Soil surface erosion risks are lower than in some other systems, because these sites are more readily revegetated. Of greater long-term concern is the slow but certain loss of early-seral tree species and associated grasses, forbs, and shrubs essential to sustain diverse wildlife habitats to advancing plant succession.

SUBJECT AREA: Interior Douglas-fir

A. Background

Douglas-fir is mainly restricted as a forest community to the eastern Manti-LaSal National Forest. It is much less common on the Fishlake and Dixie National Forests. Where it is found, it is most common on north and east aspects. Douglas-fir communities adjoin ponderosa pine or even sagebrush types at lower elevations and true firs and spruces at high elevations. Site conditions are warm and dry at lower elevations to cooler and more mesic at higher elevations. The species is adapted to a wide variation of site, climate, and soil conditions. Historical stand structures were primarily even-aged, single-canopy stands. Douglas-fir is associated with a variety of insects and diseases including Douglas-fir beetle, Douglas-fir tussock moth and dwarf mistletoe. Fire regimes were usually non-lethal at frequencies of 10 to 25 years on dry sites, and 30 to 50 years on cooler/wetter sites. This community provides nesting and foraging sites for goshawks, Mexican spotted owls, elk and mule deer.

B. Assessment

Current structures are typified by mid- to mature age/size classes, with limited amounts of old growth trees. This small proportion of old growth is due to disease activities, insect epidemics and past harvest practices. Relatively few areas are in the seedling and sapling structural stage. Because Douglas-fir often grows on steep terrain, management activities may be limited. Most stands have not burned in the past 100 years and are increasingly susceptible to stand replacement fires. Ladder fuels exist where plant succession has led to dense regeneration of Douglas-fir and true firs under existing canopies. Douglas-fir beetle is currently at epidemic levels on parts of the Wasatch Plateau, but remains at endemic levels throughout most of the rest of the Sub-Region. Douglas-fir in some areas is moving into sagebrush and mountain brush types in the absence fire.

C. Risk

The most significant risk is associated with intense stand replacement fires outside historical ranges of intensity and size. A post-fire increase in herbaceous vegetation may temporarily improve habitat for ungulates such as elk, deer and domestic livestock. But the historical balance of patterns and structures will be compromised by large stand-replacing fires, or continued exclusion of frequent non-lethal fires. Such unbalanced patterns provide poor habitat for the suite of animal and plant species which historically inhabited this forest type. In addition to unplanned

vegetation changes, more intense disturbances have significant negative effects on soil and water quality. Potential loss or reduction of habitat conditions for late-seral dependent wildlife species is high.

Insect populations are at epidemic levels on the Wasatch Plateau. Sites become more susceptible to Douglas-fir tussock moth defoliation as stand densities increase through time. Susceptibility to Douglas-fir beetle increases as tree diameter and stand densities increase. Disturbances caused by defoliation or windthrow and extended periods of drought, also increase tree susceptibility to bark beetles in older, dense stands of Douglas-fir. Dwarf mistletoe is very common. In some areas, levels of infection are moderate to high reducing viability of infected trees.

SUBJECT AREA: Ponderosa Pine

A. Background

In the Sub-Region this community is found between Gambel oak and/or sagebrush at lower elevations and mixed conifers (Douglas-fir and/or white fir) at higher elevations. Common associated species include Gambel oak, Rocky Mountain juniper and manzanita. Stand structures are normally multi-layered with a range of tree sizes. The climate is warm and dry with annual precipitation of 16 to 24 inches. Historical fire regimes include non-lethal fires at intervals of 5 to 25 years. Some of the best goshawk, flammulated owl and wild turkey habitat in the Region occurs in these open forests and woodlands. Mexican spotted owl forages in this habitat.

B. Assessment

Exclusion of frequent non-lethal fires has allowed much of this forest community to advance to later successional stages. Structures are predominantly made up of larger trees in the mid- to mature-aged classes, and are overly dense. Early seral species such as aspen are poorly represented. Previous harvest practices tended to remove the large older trees while retaining the smaller more dense stands.

Dense stands on the Markagunt Plateau created conditions leading to a major mountain pine beetle epidemic. Tree mortality has increased over the last six years, resulting in pockets of mortality at times exceeding 500 trees. This epidemic is expected to increase in size and intensity. Dwarf mistletoe affects approximately one-fourth of ponderosa pine.

Fires have not been active in these areas for the last 100 years. Ladder fuels are well developed and contribute to wildfires outside the historical range in intensity and size. In addition to ladder fuels, there is a build up of forest litter increasing potential fire hazard and lethal fire effects on vegetation by concentrating heat on the upper soil layers and around the stems of trees and shrubs. Past harvest and thinning has developed local areas of high fuel loads.

C. Risk

The risk is high for losing significant acreage of ponderosa pine forest to catastrophic wildfires similar to the recent fire on the Unita Flat area of the Dixie National Forest. This actual and potential loss will reduce habitat conditions suitable for late-seral dependent wildlife species. A post-fire increase in grass/forbs may improve habitat for ungulates such as deer, elk and domestic livestock. The historical balance of patterns and structures within the ecosystem may be compromised by large stand-replacing fires, and/or the continued exclusion of low intensity fires. With fire exclusion and livestock grazing ponderosa pine is increasing within riparian areas,

meadows and sagebrush communities. Such vegetation patterns outside the historical range of conditions provide poorer habitat for the suite of animal and plant species which historically inhabited such ponderosa pine forests. They also have greater negative impacts on soils and watershed conditions. This impact could be greatest on sensitive species such as goshawk and Mexican spotted owl.

SUBJECT AREA: Pinyon-Juniper

A. Background

Pinyon pine is generally more abundant in stands at moderate elevations, at lower elevations, juniper dominates most sites. There are two tree form juniper species in the Sub-Region: Utah juniper, and Rocky Mountain juniper.

Utah juniper grows on relatively dry sites with an annual precipitation of 10-15 inches. It does not sprout after fire. Utah juniper is a surface feeder with a shallow, spreading root system making it highly competitive with other plants. Its distribution and density have increased at lower elevations due to grazing and lack of fire, allowing it to occupy areas with deeper soils. As it increases on these sites, it displaces sagebrush and in some instances mountain brush communities. Pinyon pine becomes more abundant on sites where annual precipitation exceeds 18 inches.

Rocky Mountain juniper is found on somewhat more moist sites than Utah juniper, with 14-20 inches of annual precipitation. Its distribution has not expanded as extensively as Utah juniper. This juniper is characterized by a heavy seed, high water use, and limited value to ungulates for browse. Expansion of its distribution to lower elevations is limited by drought; expansion into more mesic sites is limited by more competitive conifers.

The pinyon-juniper habitat is very important to many wildlife species such as salamanders, lizards, small snakes, black-tailed jackrabbit, elk, mule deer, swallows, ravens, bluebirds, kinglets, and insectivorous warblers.

B. Assessment

Pinyon-juniper currently exceeds its historical distribution and density by as much as 60 percent. While the number of fire starts (initiations) is similar to the historical pattern; fires are generally smaller in area. Consequently, the proportion of stands in early to mid seral condition is less than characteristic under historical conditions. However, large fires occur when weather and fuel conditions are extreme. They burn as wind-driven crown fires that stop only when the wind stops or when the canopy becomes less dense. Thousands of acres may burn at a time. The change from low-intensity surface fires to stand-replacing crown fires demonstrates the radical change in the fire regime.

Erosion rates in dense stands are accelerated because there is little understory vegetation to help retain the soil in the overmature stands of juniper. This is due to a combination of factors including reduction of fine fuels from livestock grazing with the concomitant increased efficiency in fire suppression. Structural stages are strongly weighted to stands much denser than typical under historical conditions. This stand structure is not considered a properly functioning condition.

Pinyon-juniper is typically found between conifer forest and sagebrush vegetation communities

and has not increased in geographic extent as much as it has in density. The grass/forb component in overmature and dense stands of pinyon-juniper is substantially reduced as a result of competition for available moisture by pinyon-juniper plants, and the herbaceous understory may be unable to respond following a fire. Watershed conditions are deteriorating from decreased soil cover leading to increased overland flow and soil erosion. Loss of native grass and forb cover decreases the acreage of wildfires due to lack of fine fuels necessary to carry fire. Historical fires regulated the distribution of pinyon-juniper and the overstory/understory ratios.

Most insect and disease activity is endemic, although on some sites abundant activity can be observed. Dwarf and true mistletoe are widespread throughout pinyon-juniper communities. Pockets of black stain and pinyon ips bark beetle vary throughout the range of pinyon-juniper.

C. Risk

The risk associated with this cover type is high because of accelerated erosion caused by reduced herbaceous ground cover. The area affected is significant throughout the Sub-Region. Unbalanced densities (structure), composition, and pattern are indicators of improperly functioning conditions; and have diminishing value as wildlife habitat.

SUBJECT AREA: Mountain Mahogany

A. Background

Two major mountain mahogany species are found within the Sub-Region, curl-leaf mountain mahogany and birch leaf mountain mahogany. To evaluate risk and develop management strategies, resource specialists must understand the differences between these species. Both species are highly desired forage by wildlife and livestock. The nutritious forage provided by the mountain mahoganies make these sites highly important winter ranges for wildlife, especially on south or west-facing slopes.

Birch leaf mountain mahogany is deciduous and sprouts following fires. It is typically found on calcareous parent materials. It is very resilient to use and disturbance events, and it tolerates extended periods of drought.

Curl-leaf mountain mahogany is evergreen, has a tree-like form, and has a number of disease pathogens. It is also often found on calcareous substrates but may grow on other substrates as well. Because it does not resprout after burning and reproduces by only seed; it has been difficult to regenerate. Wildfires have killed some areas of curl-leaf mountain mahogany and subsequent regeneration is often poor. Many stands of curl-leaf mountain mahogany have been heavily browsed resulting in a "highlined" condition.

Birch leaf mountain mahogany has also declined in cover; primarily on south slopes as a result of heavy browsing pressure by domestic and wild ungulates with concomitant increase in bare soil. Use by elk, deer, bighorn sheep and moose is high.

A third mountain mahogany (dwarf or little-leaf mountain mahogany) is found in the Sub-Region; but it is limited in area and typically does not form communities of any appreciable extent. Typically it is found as scattered individuals on very rocky substrates growing in crevices in rocks.

B. Assessment

Curl-leaf mountain mahogany has been heavily browsed throughout the Sub-Region as evidenced by the "highlined" condition. This species is primarily in an old structural condition and not successfully regenerating. The heaviest losses of this community are on dry southerly slopes at low to moderate elevations. Livestock, large ungulate wildlife and small mammals are adversely affecting this species ability to regenerate. Its large seed is a preferred food of rodents, further impacting regeneration. Overgrazing by ungulates is reducing ground cover and degrading general watershed conditions.

Birch leaf mahogany has an advantage regenerating, since it resprouts after fire or browsing. Vegetative cover on southerly aspects has been reduced by use; especially on sites where wild ungulate use on winter range is heavy. On these sites, higher amounts of bare soil are now present. Although this species remains in good condition on north facing slopes, the continued loss on southerly aspects will eventually lead to a decline on north aspects, as ungulates search for food.

C. Risk

The risk is low to moderate for a slow continued decline of curl-leaf and birch leaf mountain mahogany in the Sub-Region. This is somewhat in contrast to the Region as a whole where some areas have a high risk. In this Sub-Region the mahoganies have generally better vigor than in other parts of the Region. Importance as a valuable forage for native wildlife increases their value. Some populations are decadent and regeneration is not keeping up with mortality. Old age and inadequate reproduction of existing plants constitute a long-term risk of losing the community in some places. Exposed soil area increases as shrub and herbaceous vegetation is lost, and watershed values are adversely affected. Continued heavy use by ungulates will prevent regeneration, causing loss of soil and watershed values. Insects and pathogens tend to be at endemic levels and do not normally pose a threat to stands.

SUBJECT AREA: Gambel Oak

A. Background

Distribution of Gambel oak is primarily limited to foothills in eastern and southern Utah. This prolific sprouter occurs in extensive stands throughout its range. On better sites, oak grows in a tree form, while on others it forms a medium to tall shrub community. Gambel oak is often best developed on west facing slopes but it is not restricted to such habitats. Today the patch size of Gambel oak is estimated to be somewhat greater than it was 100 + years ago but the geographic extent is within historical ranges. Gambel oak provides good watershed protection because it holds the soil in place by its massive root system. It also supports abundant understory grass and forb vegetation, unless it becomes so dense that species are shaded out. "Scrubby" Gambel oak is valuable habitat for salamanders and lizards, small snakes, squirrels, turkeys, mule deer, Swainson's hawk, owls, swallows, ravens, warblers and finches. Mast production makes Gambel oak communities especially important for turkeys, squirrels, mule deer and small rodents. With pines in parts of southern Utah, Gambel oak is a component of Mexican spotted owl habitat.

B. Assessment

Gambel oak is judged to be in moderate to excellent condition throughout its range. Fire intervals may be slightly longer than historical averages, but Gambel oak stand structures and conditions are sustainable. Limited areas have been lost to residential encroachment. A variety of insects are commonly associated with the oak type; however, no native insect species pose a threat to

the Gambel oak community. Most detrimental effects are temporary and are the result of fire or weather (frost). Since it is a prolific sprouter, recovery of oak communities is often rapid. Existing soil quality, hydrologic function and recycling of nutrients within oak sites is favorable and its value to wildlife seems undiminished. Additional study of Gambel oak communities is necessary to fully understand the interactions occurring within this type.

C. Risk

Most of this vegetative community is not presently at risk within the Sub-Region, except for areas where residential encroachment is occurring. With limited human use, and rapid response to disturbance (weather, browsing, fire), this ecosystem seems to be in a properly functioning condition. The mid-to-old age structures are somewhat out balance resulting in some reduction of more palatable younger age classes for wildlife use.

SUBJECT AREA: Tall Forb

A. Background

This community is considered the "flower garden" of the mountains. Historically, tall forb communities were common throughout the mountains at above 8,000 feet and where annual precipitation exceeds 35 inches. These sites are characterized as having deep, well-drained productive soils. Forbs are the dominant vegetation. Tall forb communities in association with forest and shrubland communities are valuable habitat for elk, deer, eagles, owls, and a variety of small birds (including bluebirds, hummingbirds, swallows), insects (such as butterflies) and many small mammals.

B. Assessment

More than half of the tall forb communities were lost years ago due to improper livestock (sheep) grazing, which resulted in a significant loss of the deep, fertile soils. Many sites are presently dominated by tarweed, mulesears and mountain coneflower. Site restoration is very difficult, or nearly impossible, because most (1 to 3 feet) of the loamy soils are eroded away. At best, it will require a long time, beginning with re-establishing early seral species such as geranium, lupine and yarrow; to restore these sites to their historical condition.

C. Risk

The tall forb community is at extreme risk if current grazing practices continue to degrade its composition and structure. Loss of these sites to conifer encroachment is also possible. Because flower production is adversely affected when tall forbs are lost; some sensitive, disjunct or isolated colonies of insects are also at risk of disappearing. Protecting this easily damaged and lost community is important because less than half of the original acreage is still in a properly functioning condition, and rehabilitation is often impractical.

SUBJECT AREA: Mountain Brush Complex

A. Background

The mountain brush community is a complex of several different species sharing some common characteristics. Common shrub species include: chokecherry, serviceberry, gooseberries,

mountain maple, mountain snowberry and elderberry. These species resprout after fires. Sometimes mountain mahogany and Gambel oak communities have been included in a more broadly defined mountain brush complex. The complex prefers slightly higher moisture regimes than does sagebrush, with an annual precipitation of 15 to 25 inches. The mountain brush community is found intermingled with sagebrush at mid elevations and conifer/aspen forests at higher elevations. This heterogeneous community is important because it provides diversity within a landscape. This type provides both food and cover for many kinds of wildlife.

B. Assessment

Fire control has allowed other species such as pinyon-juniper and sagebrush to replace mountain brush communities in some areas. Overgrazing by ungulates is reducing the extent and density of some mountain brush communities. Wherever this vegetative type is found on south facing slopes and is used as wildlife winter range, its extent and condition continues to decline. On north slopes, the community is generally in good condition.

C. Risk

This cover type does not cover extensive areas throughout the Sub-Region; however, locally its significance can be great. Loss of berry production, reduced grass cover, and an increase in diseases (e.g. black knot in chokecherry) will adversely affect its potential value to a wide variety of wildlife and livestock. Wherever mountain brush declines, protection of soil resources is also reduced.

SUBJECT AREA: Sagebrush/Grasslands

A. Background

There are six major species and subspecies of sagebrush in the Sub-Region. These include: Wyoming, basin and mountain big sagebrushes; and black, silver and spiked sagebrushes. (See Table 2 for a comparison of similarities and differences among these six taxa.) Based on ecological similarities and on common management requirements these six sagebrush types are placed into the following groups.

Group 1. Black sagebrush and Wyoming big sagebrush.

Both of these species are found on sites where effective soil moisture is very limited. Consequently fine fuels from grasses and forbs are naturally low and the historical fire intervals were greater than 40 years. Both species successfully reseed themselves after fire (unless the fire interval is so short as to interrupt seed production such as 5 years). These types serve as valuable winter forage areas for several wildlife species.

Group 2. Basin and mountain big sagebrush.

Due to climate and/or deep soil profiles, these two subspecies occur on sites with considerably greater soil moisture Group 1. Consequently understory grasses and forbs provide more fine fuels than in Group 1. Historical fire frequencies averaged about 20 years between fires. Fires are normally lethal to the individual sagebrush plants but the understory grasses and forbs typically resprout and are favored by periodic removal of the sagebrush.

Table 2. Comparisons of Sagebrush Community Features for Properly Functioning Condition Assessment. By sagebrush species or species group for the Southern Utah Ecogroup on the Utah High Plateaus and Mountain Section (M431C).

FEATURE	**BLACK** (*Artemisia nova*)	**WYOMING BIG** (*Artemisia tridentata* var. *wyomingensis*	**BASIN BIG** (*Artemisia tridentata* var. *tridentata*)	**MOUNTAIN BIG** (*Artemisia tridentata* var. *vaseyana*)	**SPIKED BIG & MTN. SILVER** (*Artemisia spiciformis* & *Artemisia cana*)
DISTRIBUTION	Widespread on calcareous surface soils, usually with a restrictive soil layer.	Low/Mid elevation; soils calcareous at 6 to 14 inch depths.	Low/Mid Elevation; deep, well-drained soils.	Mid/High elevation; moderate to deep soils.	Mid/High elevation uplands and riparian edges.
DISTURBANCE	Much has been plowed and seeded.	Much has been overgrazed, plowed and seeded.	Most lost to cultivation.	Much has been sprayed and seeded to crested wheatgrass	Much has been spray released.
FIRE INTERVAL	Seldom	≈40 years.	≈20 years.	≈20 years.	>40 years.
FORM	Several branched shrub.	2-3 branched shrub.	1-2 branched shrub.	2-3 branched shrub.	Multi-stemmed shrubs.
HEIGHT (mature)	1-2 ft.	2-3 ft.	Tall; 4-6+ ft.	3-4 ft.	2-3 ft.
MANAGEMENT (Palatability has been evaluated based on selection of taxa by native ungulates.)	Relatively palatable. Seed to regenerate understory forbs and grasses.	Low palatability. Seed to regenerate understory forbs and grasses.	Low palatability. Seed to regenerate understory forbs and grasses.	Relatively palatable. Seed to regenerate understory forbs and grasses or spray release.	Spray release understory forbs and grasses. Has relatively palatable flower heads.
PRECIPITATION	8-15 in/yr.	8-12 in/yr.	8-15 in/yr.	12-20 in/yr.	16-25 in/yr.
PROPORTION (of all "sages")	~20%	<5%	<5%	~65%	~10%
SPROUT/FIRE?	No	No	No	No	Yes
PROPORTION estimated in PFC. (Includes previously treated areas.)	30-40%	~15%	~15%	20-40%	40-50%

Grasses and forbs are detrimentally affected whenever sagebrush canopies exceed 15% crown cover (as measured with line intercept). Excessive crown canopies of sagebrush

and a long history of heavy livestock grazing has resulted in a major loss of understory species and an increase in bare ground in these types. Much of the area in this group have been treated to remove dense sagebrush canopies and seeded with exotic grass species; especially crested wheatgrass.

Historical fire patterns normally burned in a mosaic patterns related to fine fuel, topography and wind patterns. Under historical conditions vegetation patterns were generally patchy with several age and canopy classes represented within any single geographic area. Lower elevation portions of this type are important wintering areas for deer, elk, pronghorn and sagegrouse.

Group 3. Spiked big and mountain silver sagebrush.

Both of these species resprout after fire. Consequently, fire effects or other treatments are of shorter duration in these communities as compared to other sagebrush communities. These types naturally supported high amounts of grasses and forbs with a high level of species diversity. Both occur at moderate to high elevations. Both also currently support higher than historical amounts of sagebrush canopy cover, yet the associated remaining grasses and forbs are generally adequate to restock the stand after treatments to the sagebrush (e.g. fire, spraying, mowing).

B. Assessment

Most sagebrush stands are currently outside a balanced range of structural classes. Most presently occur as mature plants in sites with more than 15 percent sagebrush cover and greater than 20 percent bare mineral soil exposed. These conditions have significantly increased within the Sub-Region in the last 100 years, due to grazing practices and fire exclusion. The grass and forb understories, even on previously reseeded sites are diminishing because of grazing in combination with the increase in overstory sagebrush (>15 percent). Soil stability and productivity may also be seriously affected from a loss in understory vegetation. Overland flow from rain, is causing surface soil erosion and deposition in other cover types, i.e. riparian areas. Additionally, transpirational losses are occurring due to the dense sagebrush canopies. This reduces underground recharge of soil water in adjacent types, especially riparian areas.

C. Risks

The majority of acres of these types are currently outside a balanced range of structural classes and are not functioning properly. The risk of soil loss and subsequent damage to sites is high across the geographic range of sagebrush. Significant habitat loss for several avian species exists under current conditions. In the last 30 years, breeding bird counts for Brewer's Sparrow have declined at an annual rate of 6.3 percent; horned lark has decreased by 4.8 percent annually; and grasshopper sparrow counts in this habitat have declined by 18 percent per year. These habitats are experiencing the second most critical habitat loss for songbirds identified by wildlife specialists; after the critical habitat loss in riparian sites.

SUBJECT AREA: Salt Desert Shrub

A. Background

This community was added to the assessment of this Sub-Region as it is more common in the Sub-Region than it is Regionally. However, less than 1% of the Forest Service administered lands

in Sub-region have the Salt Desert Shrub community. Consequently the community is broadly defined in this assessment. It is more common at lower elevations below the mountains and plateaus. There are two major divisions within the broadly defined Salt Desert Shrub Community in the Sub-Region: 1. greasewood and 2. shadscale.

In the greasewood community, greasewood is the dominant overstory shrub. It forms virtually all of the shrub cover on most sites. Greasewood is restricted in distribution to soil conditions of moderate to deep soils (20-40"), with a high pH and alkaloid content and a high water table. Greasewood is a very persistent and long lived shrub. It can withstand heavy grazing use, mechanical and chemical treatments. Individual plants resprout after the tops have been damaged. Greasewood also reproduces by seed. Understory vegetation in this type is generally meager. Saltgrass, seepweed and several annual mustard plants are the most common understory plants on sites with high water and alkaloid content. An understory of Indian ricegrass, sand dropseed and western wheatgrass may be present on better drained sites. Cryptogramic plants are often present as understory cover. The cryptogramic layer may cover the soil surface under the greasewood plants or even spread into the interspace between plants on sites rested from grazing.

Shadscale communities within the Sub-Region are dominated by 3 main shadscale species:

1. shadscale (*Atriplex confertifolia)*
2. mat-saltbrush (*Atriplex corrugata)*
3. Castle Valley clover (*Atriplex gardneri*)

Shadscale communities occur mainly on upper benchlands and open valley bottoms at elevations below sagebrush communities. Soils are rocky, shallow and with a high pH. Understory vegetation includes several species of shrubs and grasses and some forbs. Some of the common species are: bud sage, winter fat, horsebrush, galleta grass, and the introduced species halogeton. Plants within this community are less resistant to the impact of grazing, fire and man's activities than the greasewood community. Consequently some native species have been lost or reduced to critically low amounts.

B. Assessment

Because of their soil and edaphic constraints, which effectively preclude other species, the Desert Salt Desert shrublands in the Sub-Region are generally within their historical geographic distribution. Erosion rates within the greasewood type are generally low and local with wind erosion as the major agent. In shadscale communities erosion potential from both wind and water is higher than in the greasewood communities. Fire activity is low due to lack of ground fuels and open nature of the vegetative cover. However, greasewood will burn when overstory cover becomes old and decadent. Few insects cause damage on the Desert Shrub plants.

C. Risk

The risks associated with the Desert Shrub Complex are generally low in the greasewood type and low to moderate in the shadscale type. Grazing has had more negative impact on the shadscale communities and has reduced vegetative cover density on most sites. Grazing has had a lesser impact on the greasewood type, because there is generally a less understory vegetative cover and greasewood leaves are poisonous to livestock. The Salt Desert Shrub communities are heavily used by wildlife; especially during the winter; yet appear to be self-sustaining.

A. Background

Riparian sites characteristically occupy a small amount of the land base; but they are highly productive and heavily utilized by people and animals. Many kinds of wildlife use riparian areas, including populations of Bonneville cutthroat trout, newts, salamanders, frogs, toads, turtles, small snakes, shrews, bats, beaver, weasels, otter, ducks, Cooper's hawk, small owls, flycatchers, swallows, dipper, wrens, thrushes, warblers, orioles, and sparrows use this restricted habitat. Riparian areas are the sole habitat for the sensitive species, Arizona willow. This Sub-Region is the northernmost known extent of the Arizona willow. Riparian areas in the Sub-Region are also the sole habitat for the endangered Southwestern willow flycatcher in Region 4.

Some riparian areas have disappeared because of overuse and abuse by humans and animals. Water diversion, roads, timber harvest, grazing, and trampling have been major causes of negative impacts on riparian ecosystems. Riparian areas are indicators of watershed conditions.

Live water that comprises the basis of aquatic habitat is controlled by private parties in most of the Sub-Region. Management to improve the quality and quantity of aquatic habitat is usually the result of improved upland and riparian habitat management. Some aquatic habitat improvements (such as gabions and log structures) have been built to improve aquatic habitats (pools/riffles) for the animal species that occupy those waters, including fish (Bonneville cutthroat) and snails.

B. Assessment

Riparian areas throughout the Sub-Region have been significantly affected over the past several decades. Most of these effects have been negative, including: lowering of water tables, erosion of stream channels, exotic plant encroachment (e.g. tamarisk, Russian olive), removal of beaver populations, increased water temperatures, concentrated runoff and increased sediment from road construction, and changes in vegetation density and composition. All have contributed to degradation of riparian areas. Cytospora and scale insects have adversely affected viability of cottonwood and willow species on some riparian sites.

Riparian problems begin at higher elevations on steeper slopes, and gradually increase on lower elevations and slopes. Some riparian zones suffer from loss of soil-holding vegetation. Restoring native riparian vegetation provides shade, cover, and soil protection, thereby improving water quality and fish and wildlife habitat. Interruption of historic disturbance patterns, and several decades of reduced flows, have led to a decrease in numbers of cottonwood trees. Changes in fire frequencies have encouraged succession to conifers in some areas; as conifers become dense (e.g. >40% canopy cover) they shade out deciduous species such as willow. With decreased fire influence and increased density of upland vegetation types (such as conifers, sagebrush and pinyon-juniper) some stream courses have experienced reduced flows, or have even quit flowing. Populations of several species of frogs, bats, and birds (sandhill crane, yellow warbler, Brewer's blackbird, killdeer, northern rough-winged swallow, Wilson's phalarope, and common yellowthroat) are declining significantly; in part due to diminishing riparian habitat.

Aquatic habitats have been negatively impacted over the years as a result of activities on the watersheds. As erosion increases, sediment is deposited in stream channels. This reduces the amount of exposed gravels for native fish spawning; broadens stream channels; creates shallow waters; reduces abundance and quality of pools and increases water temperatures. Streamside vegetation, food sources and cover are also reduced as stream dynamics change. All these

effects create a net loss of aquatic and riparian species diversity.

C. Risk

Risk is very high due to a variety of impacts within riparian sites (including degradation of water quality, soil stability, and wildlife habitat, and increasing human disturbances). This appears to be the **most** important ecosystem component in the Sub-Region that is currently outside properly functioning condition.

The risk of deteriorated aquatic and riparian habitats is a net loss of aquatic and riparian species, and the associated stability of the aquatic ecosystem. Recreational fishery opportunities are also at risk. The value of the aquatic and riparian habitats to any ecosystem in which they occur cannot be considered independently of that habitat.

SUB-REGIONAL SUMMARY OF PROPERLY FUNCTIONING CONDITION

After the team completed the assessment by subject areas they were subjectively ranked to reflect the relative risk to PFC at a Sub-Regional Scale. A relative risk rating of low, moderate and high is an indication of how much departure there may be from the properly functioning condition. These rankings apply only to biological and physical attributes and do not reflect management priorities when social expectations are factored in. (Not in any particular order within a class.)

High Risk

Engelmann spruce-subalpine fir
Quaking aspen
Ponderosa pine
Pinyon-juniper
Tall forb
Riparian

Moderate Risk

White fir
Mountain brush
Sagebrush
Douglas-fir
Mountain mahogany

Low Risk

Salt desert shrub
Gambel oak
Alpine